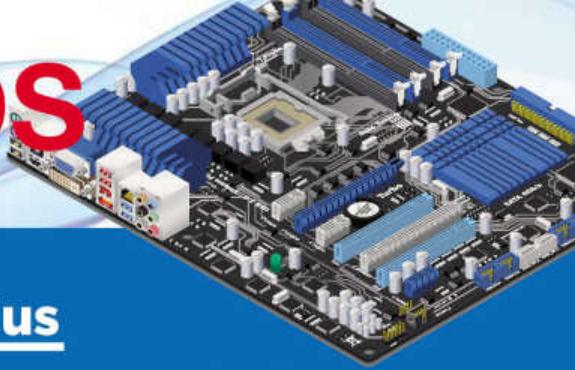


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08 Google Vs Microsoft

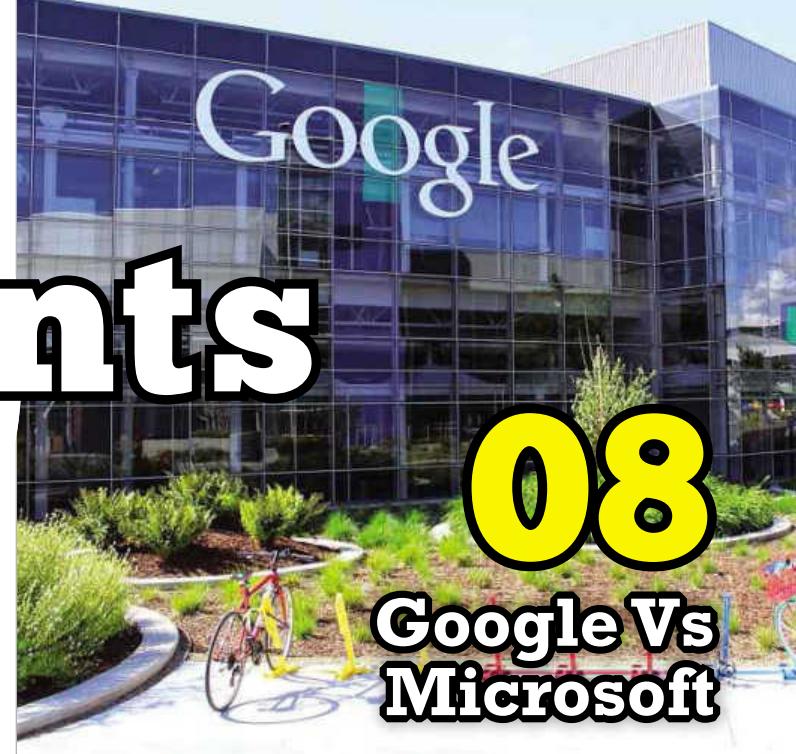
For quite a while now, these vast companies have been encroaching on each other's territory, with Google arguably having the upper hand in recent years. Microsoft is too big and has too much history to be taken down so easily, though, and its latest tactics suggest it's not going down without a fight. David Crookes looks at what it has planned and how things are likely to turn out

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52 4K Displays On Test

60 Keyboard Layouts

52 4K Displays On Test

Thanks to the close proximity at which people tend to use monitors, they're ideal for showing off high-resolutions, because you can fully appreciate all the extra pixels that are on offer. The latest big thing in display technology is 4K, of course, so if you're looking to join this bandwagon, then one of this week's hopefults could be just what you're after

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Windows 10 has lots of new features, and among them is Groove, a music player and CD ripper. As with most new software, there are plenty of things to try out and explore. To help you get the most from this program and really get your groove on, Roland Waddilove is back with another selection of top tips

62 Keyboard Layouts

Have you ever wondered why we use the keyboard layouts we do? Is QWERTY really the most efficient system we could be using? We've been exploring this topic, finding out how we came to be using the keyboard layouts we do, as well as why the French desperately want to change theirs



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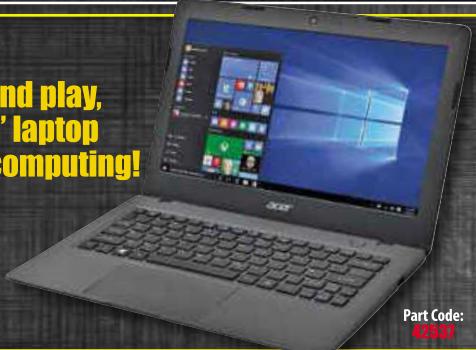
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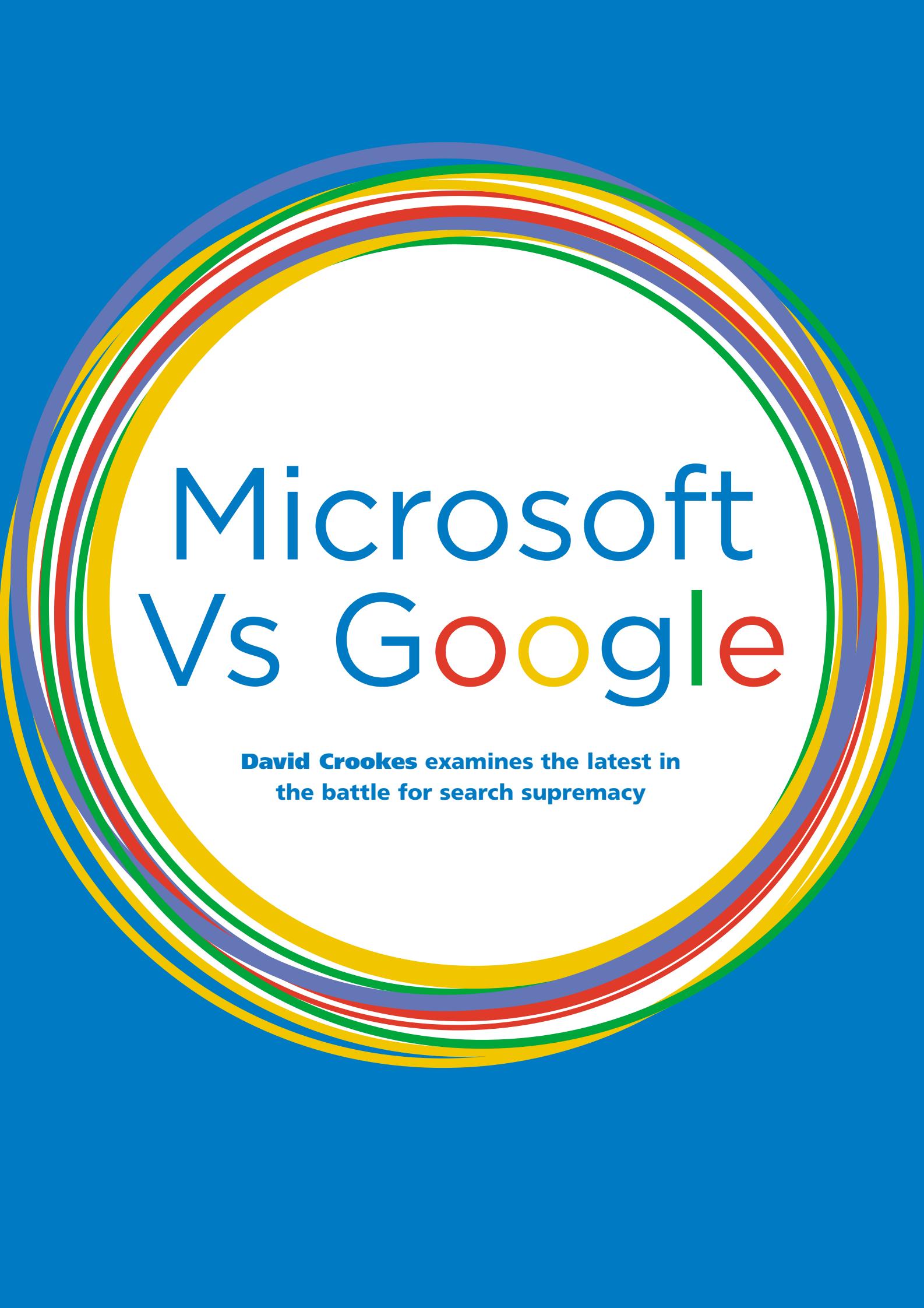


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Microsoft Vs Google

**David Crookes examines the latest in
the battle for search supremacy**



There was a time, not that long ago, when many a pundit suggested Microsoft's attempt to take on Google in the search engine market was doomed to failure. Bing, which launched to great fanfare in 2009 as the replacement for Windows Live Search, had been ailing, falling well short in its bid to overturn the market leader, and it seemed likely Microsoft would just give up and concentrate on bolstering its operating system instead.

But it was always going to be difficult to take on an established brand like Google. People, after all, speak of 'googling' when searching the web, the brand having long become an eponym to join the likes of Band Aid, Hoover and Kleenex. And while that actually annoys Google too (in 2003, its lawyers sought to keep the word out of our dictionaries), it does mean that anyone trying to beat it really does have a job on its hand. To succeed, a company has to be prepared to fight.

As far as Microsoft is concerned, Bing is a good product worth fighting for. At launch, the company spoke of it being a Decision Engine that allowed people to make faster, more informed decisions

and, over the years, it has got better and better. Slowly, but surely, Microsoft has been improving its service to the point that it has a better image search than Google, with pop-up enlargements, a Favourites option and a filter that looks for people's faces.

and come up with various schemes. Today, while Bing still plays second fiddle to Google, it's not quite as bad as it once was. In fact, it's speeding up the table: in 2011, Bing overtook Yahoo!, which used to take for granted its position as the number two search engine. Then in

66 72.26% use Google, while 12.12% use Bing 99

Bing also has great video searching that displays results in a grid, a desktop widget for easy searching, very detailed search results that appear as you type and, to add a cherry on the cake, a nice picture on the home page. And yet, for a good long time, we'd bet that when faced with the brand Bing, a lot of people actually thought not of a search engine but of Bing Crosby, an American actor and singer who died 39 years ago. Bing's brand recognition was that bad.

In an attempt to correct things, Microsoft struggled like mad to knock Google off its perch. It has chipped away

a move that showed how far Yahoo! had fallen, it even started to power its results.

But in 2015, Bing moved apace and took a market share in excess of 20% for the very first time in the US. Suddenly, Google's search service was losing ground to Bing. Sure, the global figures by netmarketshare still show a tremendous gap (72.26% use Google while 12.12% use Bing), but a renewed push by Microsoft CEO Satya Nadella to get its service noticed is certainly having an effect. With each salvo it fires, it appears to add more people to its search engine party.



Fighting Battles

Microsoft began its series of battles right from the start. Within a year of launching Bing, it had proven to be very aggressive in pushing the service, particularly in the US, where it introduced the Bing Rewards program in 2010. This had proven to be popular in allowing searchers to amass points, which can then be used to obtain gift cards for retailers such as Amazon, Sephora and Starbucks. Attracting big names from GameStop to Dominos and Burger King, it became possible for users to swap credits for fuel and airline miles, donate credits to local charities and schools, and enter sweepstakes that allow people to win games consoles and tablets.

But it didn't stop there. It began paying companies to drive traffic to Bing and, as a further sign of the confidence Microsoft began to have in its search engine, it separated itself from Facebook. It used to be the case that you had to sign into the Rewards with a Facebook account, a method many prefer since it's easier than registering from scratch. Yet from 15th February 2015, it required a Microsoft account. But those were mere drops in the ocean compared to the next move. This time, it has decided to be ruthless and cut Google away from one of its key services. At the end of April, it announced that it had decided anyone using its Cortana digital assistant in Windows 10 would, from now on, only get results from Bing.

Now, this has long been on the cards, at least in hindsight, because Windows 10 is giving Microsoft a lot more power. The operating system's search bar was one of the biggest changes, because it went from merely looking up stuff on your computer to being a tool that reaches out to the world wide web. It defaults to Bing, so it has naturally given the search engine a boost. When added to all the other Bing services hardwired into the operating system, it's clear there's a pattern.

Indeed, one of the reasons we guess Windows 10 was given away for free was not simply to be nice or to make for a unified, more easily operable system across numerous devices. It offers a package that pushes the new way Microsoft aims to work in. By making sure



Cortana becomes Bing-only, the potential for a greater search share is opened up and with that the potential for even better advertising revenue. Google may well be running away with the mobile market, but Microsoft is determined it won't take the desktop too.

The crux of all of this is that previously Cortana users had been able to state Google as their preference, but that option has been entirely removed. To explain this, Ryan Gavin, general manager of search and Cortana at Microsoft, wrote a blog post in which he said Cortana would only work effectively if it was able to depend on Bing. But the announcement went even further. Cortana will show results in the recently released Edge browser. This means those who prefer Google's Chrome, Mozilla's

Firefox or Apple's Safari will be forced to use Edge if they want to use Microsoft's voice-activated personal assistant.

It couldn't be better timed. Microsoft is attempting to force more traffic towards Bing by using a feature it hopes will become integral to Windows 10. And it comes just months after it emerged that Bing had added more than a billion dollars to Microsoft's quarterly earnings as it continues to slowly eat away at Google's core business. Even as recently as April it emerged how effective Microsoft's strategy has been. Search advertising revenue excluding traffic acquisition costs, the company said, grew 18% in constant currency, with continued benefit from Windows 10 usage. By cutting off Google in such a dramatic fashion with Cortana, it has made a true

Rise Of The Bots

There have been growing claims that Facebook Messenger is set to be a threat to search in the near future. Facebook is making use of bots – software applications programmed to automatically perform tasks over the internet or pretend to be a person – and it's said that instead of heading for a browser to find something, we'll instead be sending a Facebook message and seeking answers that way.

But of course, it's not quite so simple. Google and Microsoft are working on their own bots too, and they will fiercely compete against any company looking to enter their arena. The result may well bring a real change in the way that we search and find results: typing 'Can I book a hotel in New York' in a messaging app could take you directly to a set of preferred providers. But there's no way of knowing just yet who will come to dominate this field.

What we will see, though, is innovation. At the Microsoft Build 2016 conference in March, Cortana was shown to work with Skype, picking up on conversations and performing automatic searches based on what was being said. It could be that searches are performed before you've even thought about doing it yourself. Booking that hotel? Maybe you'll want to find a taxi provider or see what there is to do when you get there.

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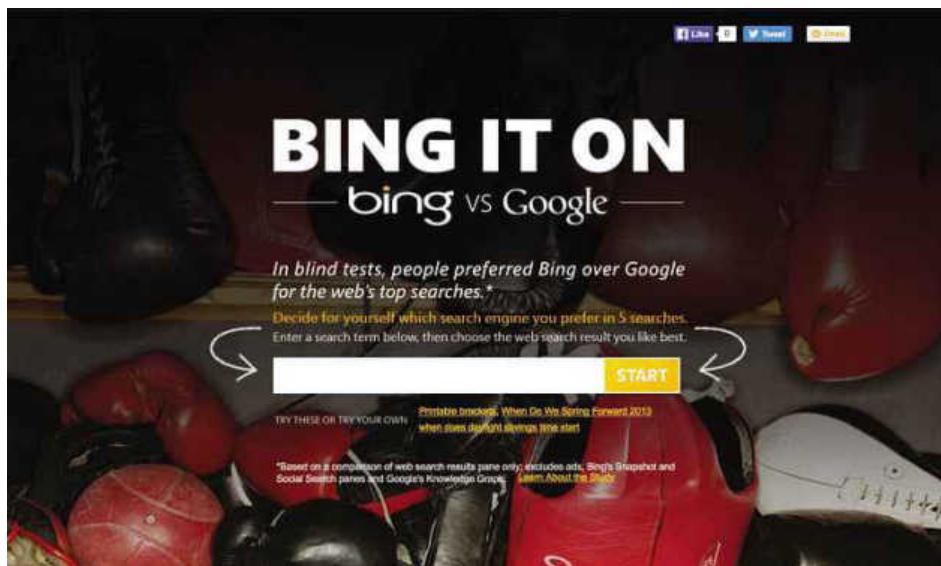
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statement of intent. It is now going for the throat.

If Mr Crosby were alive, he may want to get involved at this point and belt out 'Can't We Talk It Over?' in order to smooth relations ("Can't we sit together and figure whether this is the right thing to do?" he might well ask). But he isn't and a sit-down talk between the two parties is unlikely to take place. But why should it? Google has its own ecosystem, and it has expanded and integrated this well over the years. And as Microsoft says, the move has been prompted by the fact that some coders were working around the design of Windows 10 and redirecting users to search engines Cortana was not designed to work with.

"Cortana was designed to work with Microsoft Edge and is powered by Bing," says Gavin, before rattling off examples such as how searching for a pizza restaurant in Cortana will open the relevant site in Bing and allow Cortana to show you the closest locations, and how searching for 'Bluetooth not working' in Cortana will allow Bing to display a rich video help answer only available as a Bing search result in Windows 10.

"Unfortunately, as Windows 10 has grown in adoption and usage, we have seen some software programs circumvent the design of Windows 10 and redirect you to search providers that were not designed to work with Cortana," Gavin wrote. "The result is a compromised experience that is less reliable and predictable. The continuity of these types of task completion scenarios is disrupted if Cortana can't depend on Bing as the search provider and Microsoft Edge as the browser."

"The only way we can confidently

deliver this personalised, end-to-end search experience is through the integration of Cortana, Microsoft Edge and Bing – all designed to do more for you. Starting today, to ensure we can deliver the integrated search experience designed for Windows 10, Microsoft Edge will be the only browser that will launch when you search from the Cortana box."

Double Whammy

This hurts Google in particular, given that it delivers a blow to both its search engine and browser (although with its advertising revenue up 16% to \$18 billion, it won't be felt for quite some time). It has already led to protests from some users, though. Analyst Danny Sullivan, writing for the specialist website Searchengineland.com, said, "Personally, I think Microsoft is taking some big liberties here. I installed Google's Chrome browser as my default browser on one of my Windows 10 laptops. Google didn't trick me into doing this. It was a deliberate choice on my part."

Bing Or Google?

The only way to really test which one is best is to give it a go yourself – because the way you work could be very different to the way others work, and only by spending time on each search engine will you know which best suits your needs.

That said, there have been surveys comparing the two. One based on 1,000 participants suggested people preferred Bing by two to one. But another proved more controversial. Microsoft's Bing It On campaign attracted five million people, the idea being that they would input a search term and then tell the website which set of results appeared better.

Going to that website (bingiton.com) today will take you direct to bing.com. But Ian Ayres, of the Freakonomics website, called it out, saying the results had not been released and that in his own tests 53% preferred Google.

It's all subjective, of course. But certainly don't let a fear of change stop you trying Bing. There are lots of useful features within it that you may well find you prefer.

He says he will be forced to use Edge against his will, "all because Microsoft has unilaterally decided that's the best 'experience' for me." What's more, he draws attention to Microsoft's other salvo in the war of search: the hoops users have to go through to change the provider within Edge. First a message appears that seeks to persuade you to stay by pointing out that only Bing has direct links to Windows 10 apps, makes more relevant suggestions via Cortana and gives instant help.

Then, if you want to go ahead with the change, you have to open your search engine of choice in Edge, select More actions > Settings, scroll to View Advanced Settings and select Change in the list under 'Search in the address bar with'. You can then select the website and 'Set as default'. There is no system-wide way of moving to Google, though. Yet some analysts believe Microsoft to be well within its rights to do this.

"Cortana is a voice interface, which is tied pretty closely to the apps that it works with," analyst Rob Enderle tells us. "This will assure that it generally always works but also that it will be limited in what it can do. Eventually, I expect, Microsoft will allow Cortana to become a far more universal interface, but right now they are focusing on assuring quality rather than trying to get it to interface with everything. I think they plan to make it a lot smarter, and once they are happy that its advancement can be stabilised for a time will open up the APIs and make it available as a more generic interface. Generally, I think, most will appreciate this focus on quality and advancement over breadth."

But is it as simple as Microsoft wanting a fluid system or simply a two-pronged battle? In early May, Google Chrome was



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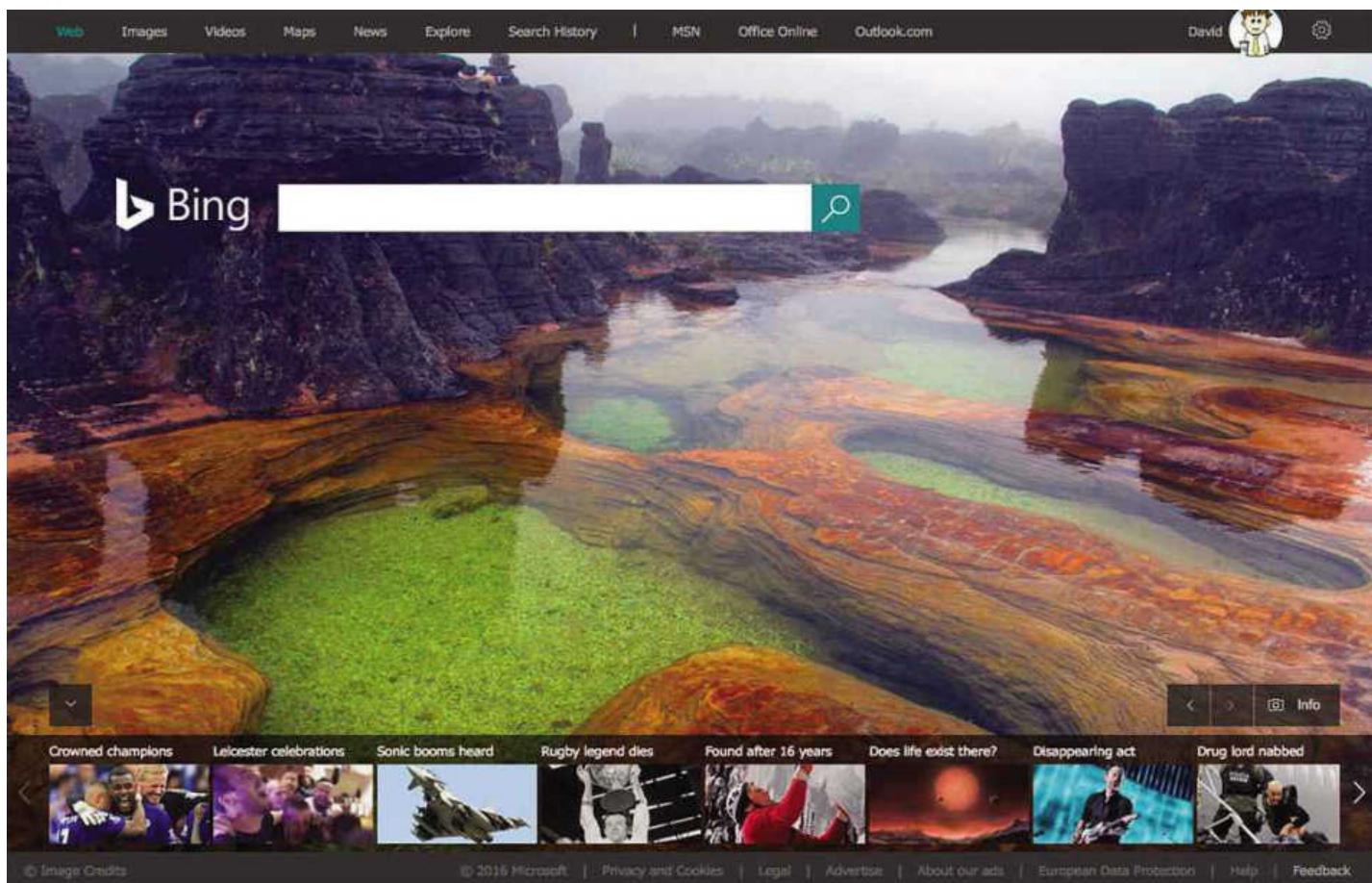


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named the most popular browser in the world, with NetMarketShare showing that it overtook Internet Explorer for the very first time following a long battle that began in 2008. It now accounts for 41.66% of the browser market, which is 0.31% more than Internet Explorer and Microsoft Edge. With Cortana only working in Edge, this will surely be a way of clawing back some of that lost ground.

End To End

In some cases, opposition to this move can be seen as Microsoft-bashing. Yes, it dominates the desktop market and, yes, it has had run-ins with regulators, which led to the browser-choice page and accusations of being anti-competitive and all of that, but it's only pursuing what Google has been doing all this time. When Google created the intelligent personal assistant Google Now, it became available in the Google Search mobile app for Android and iOS as well as in Chrome. It's just as much an end-to-end system.

Both Google and Microsoft have also spent lots of time and money on creating their ecosystems and getting them to talk to each other. For those who use each one, having teams who know their

systems inside out makes for a more fluid experience with none of the worry about compatibility. It's also fair to say that the battle is not simply about forcing a search engine on users. Both companies have been working hard on the features they offer in the hope of encouraging people to want to use their products rather than feel they just have to.

Recently, Microsoft updated its iOS Bing

Calendar and using smart tech to cross reference various apps.

The ecosystems and feature sets keep getting larger. Both Google and Bing have begun adding fuel prices to their searches in America and in the UK, and Microsoft has launched Bing Shopping, which is aimed at marketers to give them better control over their online retail campaigns. It's being used by companies such as

66 Cortana is a voice interface, which is tied pretty closely to the apps that it works with 99

app, and it now allows iPhone users to perform image searches by taking photos and looking to match them online. It notifies you when a film you're following becomes available for streaming, and it lets you find bus routes and schedules from maps. There are improved product results with data from stores such as eBay. But only in the USA, as it stands. Meanwhile, Google has been enhancing its search capabilities for Gmail, Inbox and

Littlewoods to gain an insight into how their campaigns are performing, with real-time data and the ability to import figures from rivals such as – you guessed it – Google Shopping.

"At Bing, we strive to provide useful, simple and effective tools. With Bing Shopping, we've done just that and are very excited to offer our customers this new product. With an accessible user interface and important analytical

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elements, Bing Shopping offers our customers the ability to execute a truly successful campaign," says Ravleen Beeston, UK head of sales at Bing Ads.

Fierce Expansion

But their efforts obviously don't stop in the US and UK. Microsoft and Google have been targeting the entire world, first of all seeking to lend internet access to the even the remotest of spots through various programs such as Google's Project Loon, which will use a network of balloons to connect people in rural and far away locations to help fill coverage gaps. By establishing new markets and drawing in new customers, there is an even greater chance of boosting search engine revenues.

It transforms the battle for search into a battle for territory, which in turn will foster a new battle for search. There is still so much to play for, and both sides will do all they can to take a piece of the action, boosting advertising revenues (for that is at the heart of the motivation to spread even further) and getting more and more people used to and hooked into the various ecosystems. Microsoft arguably has the biggest advantage, because there are so many millions of computers available that it can slap

Windows 10 onto. But Google will be looking to get its free ChromeOS into the wild in greater numbers and to capitalise on its ever-popular Android OS.

For the first time, Google may well have a real rival on its hands over the next few years. Microsoft is certainly going to be making sure it does. But that's not to say that the battle will only involve these

away, the companies will have to boost their feature sets even further in order to encourage movement from one to another. Google will undoubtedly be looking for a killer function that will encourage mass movement from Cortana and Edge and, likewise, Microsoft will do all it can to keep people on-side and happy. It, more than anyone, attracts the

“ The only way we can confidently deliver this personalised, end-to-end search experience is through the integration of Cortana, Microsoft Edge and Bing ”

two players. Social media companies – Facebook and Twitter in particular – are attuned to the benefits of search and of locking people into their own little gardens. Apple may even look to enter the arena, with pundits suggesting it may begin to concentrate less on the hardware in the future and more on the services that can be used on its various gadgets.

Whatever happens, there's no likely truce ahead. Users look set to benefit overall. While some choice will be taken

brickbats, so it has the most difficult job of the two.

We can only wait and see, though. When the web emerged in the mid-90s, it would have been difficult to foresee that the key battleground would be on how to effectively search and make sense of it, but that's where we are. It's the digital equivalent of the Coca-Cola versus Pepsi wars of the 1980s (Google it) but, we reckon, with far more at stake in the long run. **mm**



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Motherboards For Amateur Overclockers

New to overclocking? Find the idea intimidating? One of these motherboards will get you started

It doesn't matter how many times it's discussed or explained, overclocking PC hardware is a topic that always scares some. The idea of tinkering with your PC's internal hardware, messing with timings, voltages and other settings is something that easily scares many less-technical users off, and it's not difficult to understand why. How many people out there are scared of messing around with their cars, even the basics? There's just something about tinkering with something you don't fully understand, and the technical side of PCs is a world that simply appears far too complex for some.

Years ago, overclocking felt like something reserved for advanced users and those who were more than happy to rummage inside their system. This feeling was totally justified; people who routinely upgraded their own systems to keep on the cutting edge of the then-rapidly advancing technology were far less daunted by the idea of tweaking settings and pushing a system's performance, and far more adept at navigating the expert forums and magazines that focused on what was almost considered a 'black art'. This left many newcomers in the dark, though. Fortunately, that's simply not the case these days.

Eventually, hardware manufacturers, who didn't initially appreciate or support after-market alterations to their products, started to realise there was a healthy market for user-customised hardware, and overclocking became a common sight among the features lists emblazoned across boxes. The methods of

overclocking became easier, and what once required the use of invasive methods and hands-on tinkering (even the use of pencil lead to unlock early AMD CPUs) eventually appeared on the radar of users with little to no technical ability.

It's this more user-friendly kind of overclocking we want to focus on here. First, however, we're going to take a brief look at what overclocking is, in case you've never attempted it before. Once we've covered the basics, we're going to have a gander at a few motherboards on the market that should provide ample overclocking abilities for everyone, including newcomers.

Isn't It Dangerous?

Users who have never attempted overclocking are often scared by the prospect of messing around with the hardware they've paid good money for. As PCs and components can be expensive, it's not all that surprising many are reluctant, and the very term 'overclocking' sounds bad if you think about it. We're not clocking a component just enough, so that it can comfortably operate, we're 'over' clocking it, which conjures up images of something working too hard and even suffering damage.

Having a PC with good internal airflow, as well space around the exterior to vent this air, is paramount

If we're overworked, we rarely end up feeling great, and a long day at work can just end up with you being left tired and irritable. So why would anyone, or anything want to be overworked? Well, the term overclocking, although accurate, isn't all that much of a worry, as long as you know what you're doing. It could potentially be dangerous in terms of hardware stability and even damage, but it's rarely an issue if you're careful.

Overclocking a system, be it a CPU, GPU, or anything else is the art of pushing your hardware past the default factory settings by altering a few important hardware options. It's become so prevalent because, more often than not, PC hardware is somewhat throttled out of the box because it's configured to work at the speeds the hardware vendors have tested and found to be the optimal mix of performance and stability for a various hardware setups. Any higher performance, and the company can't provide that promise – or it would need to increase the price to use better materials or processes to do be confident doing so.

However, by tinkering with various hardware settings, chiefly speed and voltages (the two cornerstones of overclocking), you can actually improve the performance hardware in spite of these manufacturer-imposed limitations, thus unleashing its full capabilities. Advanced users can push hardware well past the envelope, but this often requires specialised equipment and physical modifications, especially in terms of cooling.

Rising Temperatures

The most common cause of problems when overclocking is overheating. All PC hardware generates heat when in operation, but if this heat becomes excessive things can start to go wrong. It's why all PCs have vents and cooling fans on the case, and why CPUs, GPUs and memory, are fitted with cooling methods – such as heat sinks, cooling pipes and mounted fans that are thermodynamically designed to funnel heat out of and away, from the component in

question. Generally, this hot air is then vented out of the PC via the cooling fans on the case.

This is what's known as airflow, and having a PC with good internal airflow, as well space around the exterior to vent this air, is paramount. In terms of overclocking, it's one of the most important aspects you need to consider.

Pushing a component harder than the vendor intended will almost always mean it runs hotter, so there's more heat to deal with. As most components like CPUs come with either a pre-fitted cooling device, or require one (if you bought a standalone chip, for example), when overclocking you have to be aware of this and be ready to upgrade your system's cooling to deal with the increased temperatures. Not doing so can cause problems.

However, we're focusing on motherboards that allow overclocking and are suitable for beginners, so the kind of overclocking that would require heavy-duty cooling, such as liquid cooling setups, won't be too much of a concern initially. If you decide to take overclocking further, though, keep them in mind.

We're going to be looking at motherboards that already include some scope for overclocking in the form of built-in options for changing the basics settings needed to ramp up the performance. Much of this can be done safely enough without the need for any extra cooling (although temperature is always something that needs to be monitored). So, if you want to dabble in overclocking, these should get you going and lead you to more manual, hands-on tinkering.

On Board

Model Asus Maximus VIII Formula

Price £280

We'll begin with a fairly expensive, but very highly recommended board for overclocking: the Asus Maximus VIII Formula. This Skylake board is a rock solid option for almost anything you can throw at it, and its overclocking performance is excellent, be it for the beginner or advanced user.



▲ **Asus Maximus VIII Formula**



▲ MSI Gaming Intel Z97

Although a little more complex than other boards featured here, which may be easier to overclock, the reason the Maximus is here is due to its stability, which stands alongside the best we've seen. Rarely will you encounter instability due to overclocking (as long as you're conservative in your changes and take your time, of course), and it can yield some impressive results. For a motherboard, it also looks pretty nifty too.

Because of the wider scope of overclocking, it's also a board that'll stick with you as you improve your overclocking skills, something other boards may not manage as you outgrow them. This ensures you'll get your money's worth. Highly recommended.

Model MSI Gaming Intel Z97

Price £140

A gaming motherboard through-and-through, the MSI Gaming Intel Z97 is a strong board for the price and one that features simple but effective overclocking in the form of the OC genie



▲ MSI Z97I AC

Which Board?

How do you know, as a beginner, which motherboards support overclocking? Well, the simple answer is that most boards these days support some form of overclocking, but to be sure, you can check for Intel boards that are designated with a Z, such as Intel Zxxx, as these all feature overclocking support by design. AMD boards will usually support it generally.

For CPU's, which will be the focus of much of your overclocking, look for Intel CPUs with a K in the name, and AMD CPUs need to be in the FX or Black families.

These are guidelines, of course, and the best way to check is to simply ask the retailer or double-check the documentation/box.

▼ *Mot all boards are equal overclockers, and some don't support it at all, so always check before you buy*



button. A single press of this gives what MSI claims is an instant 20% boost in performance, no hands-on knowledge required.

The overclocked performance is stable too, which is an important consideration for those getting started with ramping up their system's power and who may not know the best methods to slowly overclock in stages to prevent any instabilities. It's a good entry and one that allows more speed with minimal risk. A good board.

Model MSI Z97I AC

Price £85

You may think overclocking is limited to full-size PCs that utilise the standard ATX form factor, but you'd be wrong. This budget offering from MSI is actually a Mini-ITX board and so is suitable for small form factor systems. However, despite its small size, it packs in some overclocking functions that, although these fall short of most higher priced, larger boards, should easily suffice for this kind of system. After all, if you're running a Mini-ITX system, you're not likely to be running cutting edge gaming hardware.

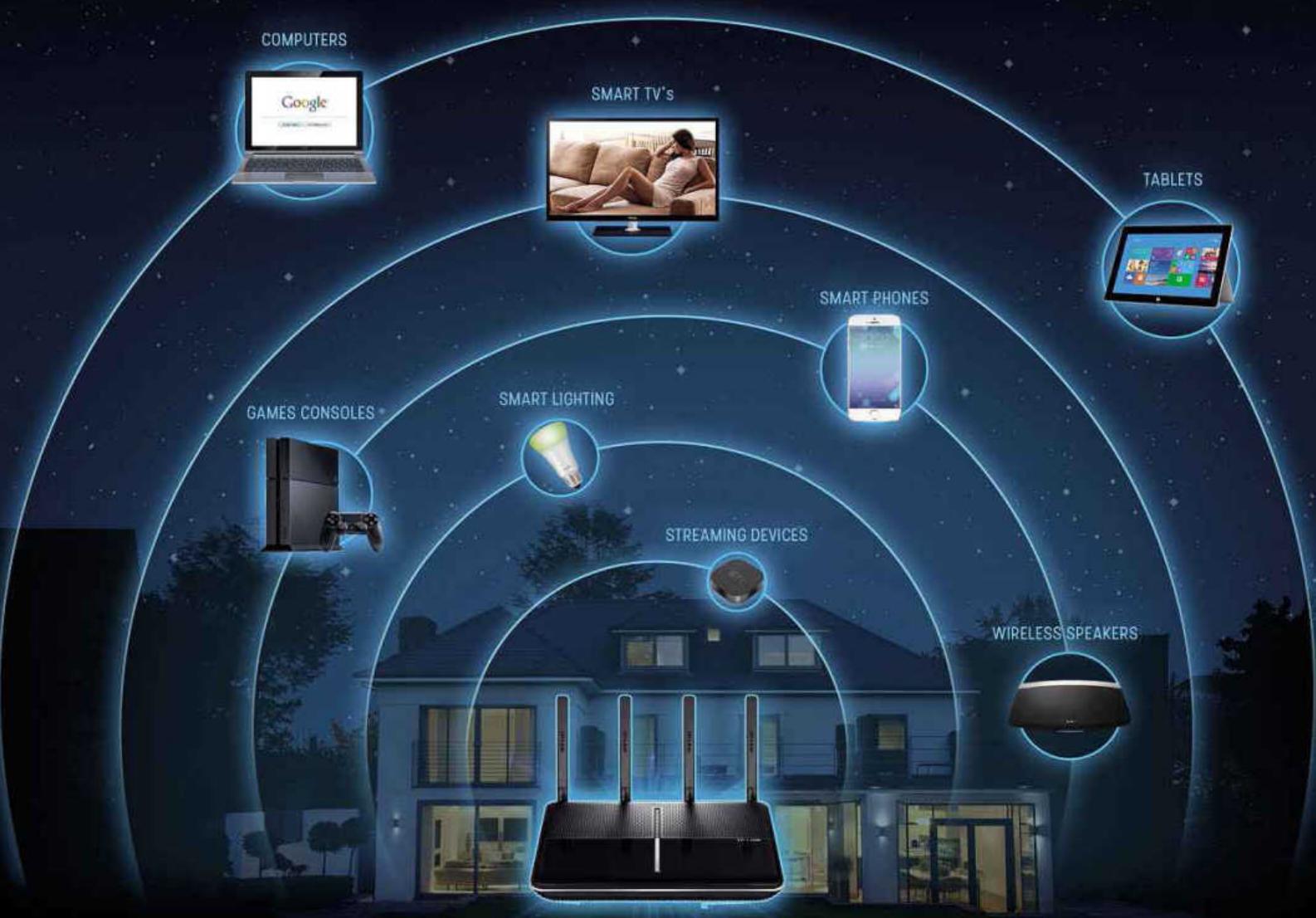
For the low price and fairly good overclocking, this is a very good option to get into the world of taxing your PC with greater speeds, and you can earn your stripes here and then move on to full-sized systems with more powerful hardware.

Model Asrock 990FX Killer/3.1 Fatal1ty

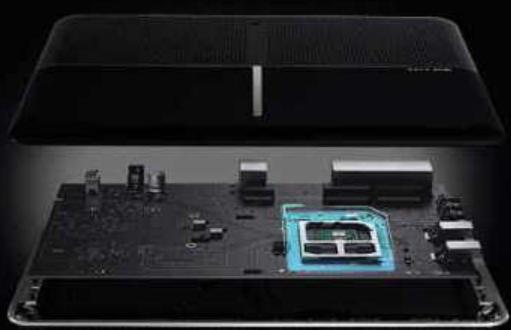
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Although a lot of the general focus these days centres around Intel when it comes to gaming and things like overclocking, AMD's CPUs are not to be sniffed at and can produce some impressive performance.

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▲ Asrock Fat 990FX Killer3.1 Fatal1ty

ASRock doesn't just make Intel boards, and there are AMD options with plenty of overclocking promise for users on a budget.

The ASRock Fat 990FX Killer3.1 Fatal1ty is one such board, and although it's cheap, costing far less than £200, it possesses a good level of overclocking, plenty for a newcomer who may not want to spend too much in order to get their feet wet, but needs some power to play with.

The BIOS is functional and easy enough to use, offering some decent overclocking performance that beats a lot of similarly priced boards. The build quality doesn't measure up to others, a common trait of ASRock's cheaper hardware, but the performance is where it counts in terms of overclocking, and this board is a good jumping-off point before you spend too much money.

Asus boards generally feature very solid build quality along with a healthy dose of overclocking capabilities

Model Asus Z170 Pro

Price £130

Asus is a very popular maker of PCs and components, and its name brings with it a strong pedigree with general consumers and enthusiasts alike. Asus boards generally feature very solid build quality along with a healthy dose of overclocking capabilities, which are also easy to use. The Asus Z170 Pro is no exception, and it's a perfectly suitable mid-range board for overclocking newcomers. It's also just a great all-round motherboard, for users of any type really.

An LGA1151 board, it features Asus' rock solid BIOS and overclocking tools, which arguably offer some of the most potential in terms of overclocking, and it manages to deliver this package without too much fuss or styling histrionics. It does come with a collection of nice features, though, like coloured LEDs that can change in response to sound input or to indicate heat levels and serving as a warning system. ALC 1150 Audio,

USB 3.1, full speed, four lane M.2 slot and support for up to 64GB DDR4 RAM are also on board too.

Although Asus' Republic of Gamers (RoG) boards steal a lot of the gaming limelight, this board, which isn't really aimed towards gaming as such, can even outperform them, making it a very good choice for the mid-range gamer looking to get some more power via overclocking.

Out Of Phase?

When looking at motherboards, especially if you're looking within overclocking circles, you may come across something called power phase. This is a specification you'll constantly see in motherboard details and in discussions, and it can be a little confusing, often meaning nothing at all to newcomers. Is it important, and should you care? Yes, you should.

In simple terms, the power phase setup of a motherboard deals with the constant and dependable supply of power to the system, and can lead to better power efficiency and less of a workload, also resulting in less heat.

Power phases are measured in numbers, such as 4+2, 6+2, and 8+2. These numbers correspond to the circuits powering the system, and how they're split between the CPU and other parts of the board, with the CPU usually getting the lion's share.

So, for example, a motherboard with a 4+2 power phase would have four circuits for the CPU, and two for everything else. These separate circuits take it in turns to supply power. So, out of the four CPU circuits, only one is ever on at a time, with each sharing 1/4 of the workload. This is meant to cause less strain on the board and components, prolonging the lifetime of your hardware. With each circuit working less, there's also not as much heat build-up, at least theoretically.

For most users, power phases aren't all that important. Indeed, some would argue they're little more than marketing speak and methods to make a product sound better and command better prices. In truth, if you're planning on overclocking, it is important, as you're pushing more power through the system, and so need to look after your components more than usual.

Many overclockers will drift towards boards with a eight-step power phase, but even a 4+2 model will be decent for most, especially those getting started.

▼ Power phases are an important element of overclocking, so check what your chosen motherboard's rating is





▲ Asus Z170 Pro

Model MSI Z170A Gaming PRO

Price £120

This is without a doubt one of the best options in terms of mid-range boards out there for the learner overclocker. In fact, it's almost a budget board in terms of price, but has the performance that doesn't place it much lower than far more expensive models.

Although there's not quite as much scope in terms of levels of overclocking you may find in some other models, MSI's overclocking tools are easy to use, and the top speeds easily compete with boards in higher price brackets. Temperatures can rest a little higher than some, though, so better cooling is more of a concern.

It supports Intel's 6th generation CPUs and up to 64GB RAM and has a rather nifty lighting system called Mystic Lights along the right-hand side, which makes it easy to match with various other mods and cases, if that's your thing.

Model Gigabyte GA-Z170X-SOC Force

Price £380

Gigabyte has a whole range dedicated to overclocking, and although this may be a board out of the reasonable price range or needs of many who simply want to delve into overclocking, it's nonetheless a high quality option, so we're including it here.

One of the main reasons for this is the easy-as-pie inclusion of the 'OC Ignition' control panel that's mounted on the actual board itself. This panel, which features an array of buttons, allows the user to alter the board's performance in numerous



▲ MSI Z170A Gaming PRO

ways. There's a one touch instant overclock that loads up an optimum performance configuration, and the option to supply continuous power to all components to ensure uninterrupted supply. You can load up customised settings with a single button press, and the board also allows these and many more features to be used when the system isn't even powered up. This means you can test out airflow performance without the PC being in operation and, for those days when you're overclocking and technical know-how have advanced, even test water cooling. Using the HW OC app, which can be installed on your mobile phone, you can even overclock the system remotely.

The board supports Intel's 6th generation CPUs and can handle up to 64GB DDR4 RAM. There's integrated Intel HD graphics, and it can take four GPUs using SLI or CrossFire. It also uses Gigabyte's

Important Overclocking Terms

As a newcomer to overclocking, you'll need to know some of the basic terms to properly understand and get used to the concepts at work. Here are some of the basics.

FSB (Front Side Bus) / Multiplier

This is the data bus that's responsible for carrying data from the CPU to the rest of the system and the RAM. The speed of the CPU's can be worked out by applying a multiplier to the FSB. Because of this, overclocking by tweaking the speed of a system's FSB was, and still is an effective way to speed up a PC. Your BIOS or software may not refer to the FSB, a lot of modern versions don't, but you'll still be playing around with multipliers, and increasing these is how the overclocking is handled.

Some more recent chips, such as Intel's Core i7 work differently, using QPI (Quick Path Interconnect), and some AMD feature built-in memory controllers. However, the FSB and multipliers remain an important consideration for many. Some CPUs will simply have a CPU speed, so you may not need to worry about this term, but it's good to know.

Turbo (various names)

Many CPUs have a Turbo mode of some description, and this is often a simple on and off option. It's an easy, hassle free way to get more from a CPU, but many CPUs (motherboard permitting), can be pushed even more by manually overclocking.

Internal Multiplier

This is simply the internal multiplier of a CPU. This is the multiplier used on the FSB to determine the system's overall speed.

Voltages

There are different voltages within a system overclockers need to be aware of, and these relate to various components on the motherboard, including the Core voltage (Vcore), the voltage for the chipset, and the memory voltage. As a lot of overclocking involves the need for more power to accommodate the greater speeds, these voltages are very important, not only to increase, but to be aware of in terms of maximum, safe levels. Too much voltage to a component that can't handle it isn't a good idea.



▲ GA-Z170X-SOC Force

exclusive Intel USB 3.1 variant, which boasts up to 16Gb/s data transfer speeds. These ports include USB Type C.

All of this, and more, makes the GA-Z170X-SOC Force a beast of a motherboard in general terms, and for overclocking it's a board that can be useful for the newcomer and will stay with you as you improve your tweaking abilities.

Model Gigabyte GA-Z87X-OC

Price £150

Sticking with the Gigabyte range of overclocking-friendly boards, the GA-Z87X-OC is a cheaper option than the Z170X, despite the fact that it possesses a host of the same features. For a start, it has the a similar, highly durable, design featuring solid capacitors, memory safe functions and Gigabyte's OC Ignition feature that allows the system to be partly powered down, shunting off power to the CPU, but keeping the motherboard and other devices powered.

It features what Gigabyte calls improved overclocking software, which features easy to use tools and offer the kind of flexibility that the company claims has been designed to break speed records. That's a bold statement, but one that the board certainly attempts to live up to.

Like the Z170X, the Gigabyte GA-Z87X-OC has the OC Touch panel, as well as other useful additions found on the more



▲ Gigabyte GA-Z87X-OC

Precautions

Before you overclock your system, even using a motherboard's built-in software, there are some things you need to do to prepare, as overclocking can lead to system instability or even damage (albeit rarely). So, don't rush in and make sure you're ready.

Always backup data

It's a commonly advised precaution, and one that's always important. You're unlikely to lose any data when overclocking, but as you're playing around with the system, it's best to be sure.

Check your system is clear of dust and debris

Overclocking will almost always produce more heat, which is bad for a PC's internal components. To ensure the best performance, and minimal problems caused by heat, ensure your PC's insides are clean and clear of dust and other dirt. Check that fans are spinning properly and aren't clogged, and make sure vents are clear. This will produce the best possible airflow using your existing hardware, and is very important.

Thermal paste is all-important

You may find this recommendation a little scary, but it's essential to make sure the thermal paste (also called thermal grease) that sits between your CPU and the cooler on top of it is in good condition. Thermal paste is the main conduit that channels the heat from the CPU to the heat sink, and if this is old, and/or not properly applied, it can lead to problems with heat dissipation, and will undermine your cooling hardware's effectiveness.

Overclockers often replace this paste regularly to ensure the best possible heat conduction, and using higher quality paste is very important when you embark on high-level overclocks.

Consider better cooling

Although you'll likely not need to worry about this at first, as you won't be making huge changes to a PC's performance, better cooling is always something to consider, and investing in a better CPU cooler, larger/more case fans, or even water cooling when you're up to it is a good idea if you plan to push your system harder and harder.

Check your warranty

Although a lot of hardware features built-in overclocking capabilities, some warranties may be voided by using them. If you perform manual overclocking with third party software, crack open the case to add new cooling hardware, or any other form of customisation, you may also void this. So, if your PC is still under warranty, double-check what you can safely do without losing your support.

expensive boards. This includes features such as external switches and a well designed UEFI GUI and dashboard.

In terms of specifications, the board supports Intel's 4th generation CPUs and can handle up to 32GB of RAM. The staple Intel HD graphics are integrated, and it supports four-way SLI and CrossFire cards. **mm**

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Hardware Security Solutions

One of the very first things any user should do when they turn on a new computer for the first time is check for security software. Before going online, it's best to have a firewall, anti-virus and anti-spyware application in place. Of course, that's not always possible, because you probably have to go online to download these things, but the point remains the same: get your security software in place as soon as possible.

However, as important as software is for keeping your computer and your files safe, you can lock things down even more by using physical measures too. Security hardware might not make as many headlines as software solutions, but if you're serious about keeping your computer and data away from unwelcome parties, it's a route you should seriously consider.

Of course, unlike software, there are no free lunches here. If you want to use hardware to secure your PC, then you'll need to put your hand in your pocket and pay for it. Prices for such products differ massively depending on what they offer and where you get

When software isn't enough, take your PC security to the next level...

them from, but some security hardware is very expensive. The good news, though, is that a lot of the more pricey stuff is designed for professional use, so you probably won't need to spend that much. And as we'll see shortly, there are ways to use hardware that you might already own, so although they're not necessarily free, at least you've already paid for them.

PC Theft Prevention

Before we look at hardware methods to secure your files, let's begin by considering ways to prevent your actual computer from being stolen. For obvious reasons, this is more of a problem with laptops, but if you're in the habit of taking your desktop PC to LAN parties or if you run a business where your computers are in reach of the public, then it's also applicable to you.

Probably the most popular anti-theft system for computers is the Kensington Security Slot. Created by the Kryptonite Corporation in 1999, this security anchoring system has since become property of



the Kensington Computer Products Group. It's found on all almost all laptops, as well as many desktop PC cases, monitors, projectors and even games consoles. As you probably know, it consists of a small hole, reinforced with metal. To this you attach a special lock, which has a metal cable with a loop that you wrap around something heavier or difficult to move, such as a table leg.

Kensington itself sells locks, including a combination lock from Amazon, for around £20: (goo.gl/MxJr7). This might seem expensive for a cable, but this is a high-quality product, which offers around 10,000 possible combinations, and its solid construction means it won't just break if a thief tries to make off with your PC. You can see the rest of the Kensington range of locks at www.kensington.com, which includes locks that use keys rather than combinations.

Also on Amazon (and elsewhere on the web), you'll find locks that cost as little £2, made by third parties. These might seem like a good idea, because they're just metal cables with locks at the end, but they're not worth it. The metal cable might be strong enough, but the questionable quality of the locks themselves mean you might end up with the cable stuck on your computer permanently.

However, you don't necessarily need to spend 20 quid to get a decent Kensington-compatible lock. Right now, for example, Lambdatek has a Dell lock on sale for £7.44 (goo.gl/CTqnk9). There are many more such locks, with similar prices, but whatever you choose, it makes sense to go for one from a brand you can trust or from a retailer with a good refund policy.

What if your computer doesn't have a Kensington slot? For example, certain MacBooks don't have one, because they're so thin, so there's no room for the lock to turn inside the shell of the laptop. The solution in this instance is a special case that the MacBook sits in and which you attach the bundled lock to. You can get this direct from Maclocks (goo.gl/EVR0MO). At £50, though, it's not cheap, and it's not much good if you don't own an expensive Apple machine.

One possible solution is a Kensington laptop locking station. Designed for laptops between 13.3" and 17" in size, it's made with a steel interior, and it attaches to the frame of your laptop, secured by a lock and key. Because it doesn't rely on a potentially vulnerable Kensington slot or a cable, it's possibly more secure, but it's not the most convenient or versatile solution: you'll need to screw the base to your desk before you can use it. Also, it costs about £40 (Amazon – goo.gl/gFKN6K),

although you might consider that a worthy investment if your laptop is valuable to you.

Desktop users might be interested in something like the Tryten Universal Computer Lock Kit Standard (T3) (£16 – goo.gl/EjqfrK). This comes with a number of accessories and attachments so you can secure your PC, monitor and peripherals. One problem we have with it is that some of the attachments are affixed using superglue, but it isn't a huge drawback.

Encrypted Storage

Even with the best planning and security measures in the world, it's almost impossible to prevent other people getting access to your computer. But that doesn't mean they should be able to access your files. You can, of course, use encryption software to protect your data, but you can also take things further by keeping your most important files on a separate hard drive or flash disk, complete with its own encryption and maybe even a physical number pad.

iStorage (www.istorage-uk.com) is an expert in this field, with its range of PIN-protected drives. Starting from £29.99, for example, you can get a Datashtur Personal USB 2.0 flash drive with 8GB of storage (16GB and 32GB models are also available), which comes with its own keypad, providing AES 256-bit hardware encryption, negating the need for software.

If your needs are more advanced, then iStorage also has the Datashtur and Datashtur Pro ranges, which include extra features, like water and dust resistance, greater capacities and more.

The maximum-sized drive you'll get with these, though, is the 64GB USB 3.0 Datashtur Pro (£129 – goo.gl/TKT2Ng). If you need more





than that, then you'll need to look at the company's other products, which use either hard drives or SSDs for storage. There are quite a few different models available, including a USB 3.0 desktop hard drive version that can have as much as 8TB of space and costs up to £479. There's no doubt these drives can get pretty expensive, especially with the higher-capacity SSD versions, but you're paying for the military grade encryption and customer support as much as anything. Anyway, if you're looking to spend this much on a secure drive, you're probably guarding something of great value, and you're probably doing it for a business, so such expense is less of an issue. Home users will most likely be looking to buy from iStorage's 'Personal' range, but it's worth checking out the company's website to see what best fits your needs and budget.

If you don't need this level of protection or capacity, then you can also pick up encrypted flash drives that don't a keypad. They're still hardware encrypted, though, so the unlock key is built right into the drives themselves. Your options here are numerous, and all the major names offer something that can fulfil this role. The 4GB Integral Courier Advanced Encryption Standard flash drive, for example, can be yours from Ebuyer for just £9.36 (goo.gl/rUs3H5). The Integral 32GB Secure Key, meanwhile, is currently on sale at MyMemory for just £12.95 (goo.gl/AoYa09). There are loads more too, and they all offer a reasonable solution for anyone needing affordable hardware encryption for their files.

Fingerprint Scanners

Both Samsung and Apple have included fingerprint readers in their newer smartphones, so it's safe to say this technology is ready for the



Create A Hardware Key For Your PC

If you want to, you can use certain programs to turn a regular USB flash drive into a security key for your PC. Without this drive plugged into your computer, others will not be able to access the system. And if you lose the key, then it's not the end of the world, since most of these programs also allow you to unlock your computer with a password too. The USB key, however, provides a quick and easy way to unlock your PC, so you can set a particularly long, complex backup password to increase security.

As for the actual software, you have a few choices. One popular option is Predator. This Windows-only program comes with a ten-day trial, after which you have to purchase either the Home Edition (US\$10) or the Professional Edition (\$15). There's also a Professional Edition with one year of support for \$30. Find out more at goo.gl/Gg9Ecc.

Also worth checking out is Rohos Logon Key (goo.gl/N17Re), which has the added benefit of being available for both Windows and Mac OS X. This offers a two-factor authentication option, so when you insert the flash drive, you have to enter a PIN code too. Also, it promises to work even when Windows is launched in Safe Mode. It comes with a 15-day trial, after which it will set you back £21.84.

Those who would prefer to pay nothing at all, however, might like to try the open-source USB Raptor (goo.gl/yZZBgB). This program checks for the presence of a particular encrypted file, which is stored on the flash drive of your choice. If it can't find this file, the PC locks the user out. Plug in the drive and you're granted access. You can also set backup passwords, and there's an option for a network override too. Check the Sourceforge wiki for more details on how to set it up.

mainstream. Indeed, a fair few laptops also include this feature, but if you want to add it to a system that doesn't already have it, then you need to buy a new peripheral.

The most obvious thing would be a dedicated fingerprint scanner, but despite (or perhaps because of) this technology's prevalence in other devices, there isn't that much choice when it comes to external fingerprint readers. A quick search for 'fingerprint scanner' in eBay, Amazon and Google Shopping, for example, will return results for products made by companies such as Eikon, SecuGen, APC and Digital Persona, which are either too small or too specialist for us to have heard of them before. That's not to say their fingerprint scanners are no good, but it's odd that the only scanner we found from a mainstream technology firm was a Microsoft model that is discontinued and only works with Windows XP or Vista.

Prices of fingerprint readers vary massively too, from as little as a tenner (goo.gl/m8wzOe) to over £100 (goo.gl/FQPXL6). The cheaper ones tend to use a swipe-style reader, while more expensive readers allow you to press your finger or thumb down on a sensor for it to be read. How well they work is hard to say, because we haven't had a chance to test them, and user reviews are fairly thin on the ground. For that reason, we'd suggest trying one out before you buy. If that's not possible, then buy it online, so you're protected by the usual 14-day cooling-off period, which will give you enough time to see if your chosen scanner works with your PC.

Another option would be to buy a keyboard or even a mouse with a built-in fingerprint reader. We'll



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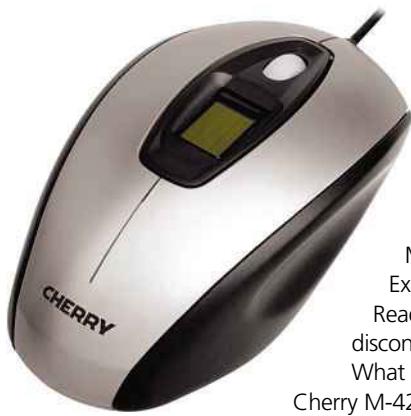
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start with the mice first. Again, Microsoft did produce a mouse with a fingerprint scanner built in, but the Microsoft Wireless IntelliMouse Explorer with Fingerprint

Reader now seems to have been discontinued.

What is available to buy, though, is the Cherry M-4230 USB Mouse with Integrated TCS2 Biometric Sensor. Good luck finding it in

stock in a UK store, though. If you order, it'll most likely be coming from America, which will mean a fairly long wait for delivery. If that doesn't bother you, then one place you can get it is B & H Photo for \$139.95 (goo.gl/X5tRMI), but that's before any customs charges you might have to pay.

It's probably safe to say that the fingerprint-reading mouse hasn't exactly taken off. Keyboards with the same technology, however, are a little easier to come by. That might not be much use if you're a laptop user, but provided you can actually accommodate a new keyboard, something like the Lenovo Preferred Pro USB Fingerprint Keyboard might appeal to you. Currently available from Kikatek for £44 (goo.gl/z0TRJ4), it's a full QWERTY keyboard with a full-size numpad. And, of course, it has an integrated fingerprint scanner, which you can use with the appropriate software to replace Windows passwords, BIOS passwords and more.

If you've got more money than sense, then you be tempted by the Cherry G83-14550 from Lambdatek (goo.gl/06Z8HV), currently on sale for a whopping £170.40. Other than the price, all you need to know about this keyboard is that it has a fingerprint scanner, but it doesn't have mechanical keys or anything else to justify its high price. One to avoid.

Beyond these two, there's not much else around. Microsoft did release a keyboard with a fingerprint scanner, but like its other biometric products, this doesn't appear to be available any longer.

Eye Scanners

If you think it's hard to get a fingerprint scanner, it's nothing compared to the current market for consumer-level eye scanners. These are also much more expensive. Currently, the only freely available eye scanner in the UK is the Eye-Lock Myris, which is a hockey-puck-shaped device that scans the user's iris. That information is then used instead of character-based passwords. There are couple of problems with this. One: it costs about £280 (Amazon – goo.gl/iG7tJj). And two: it doesn't really work very well (according the tech blog Mashable – goo.gl/uxkF29).

Similar to the Myris is the Iritech IriShield. Currently available for \$190 from Fulcrum Biometrics (goo.gl/RazkFE), it also reads



the user's iris. It doesn't, however, appear to be aimed at the consumer market at all, so you won't find it on any mainstream retail sites.

Clearly, the demand for biometric security isn't that great among regular users. Microsoft seems to have dabbled in it briefly, before giving up, and only smaller, more specialist companies still seem to be selling such products in the UK. This seems strange, considering how useful fingerprint scanners in particular can be for logging into home computers and websites. For the majority of us, though, a decent password manager will probably be all we need anyway.

The best hardware for securing files, though, would appear to be encrypted storage, whether you opt for a simple flash drive with a hardware encryption key or something more sophisticated like the Datashur range.

Such measures could prove invaluable too, if your PC is stolen. A Kensington lock might slow down a thief or prevent a quick snatch and grab, but a determined criminal can fairly easily break this slot or cut through the lock's cable, given enough time. If that happens, you'll be grateful if all your important files are inaccessible to the thief.

Ideally, though, a combination of all these measures can be used, along with decent software, to limit, if not eliminate, the anguish of your computer's security being compromised. **mm**

Put Your Best Face Forwards

Although video calling hasn't taken off quite as well as many of us expected it would (particularly filmmakers), the vast majority of laptops now come with webcams built into them. And if you're a desktop user, there's a good chance you own a webcam too, whether you actually use it or just keep it in a drawer – having bought it when videocalling was in vogue.

Assuming you do have a webcam, then you already own a piece of hardware that can be used to lock your PC. Yes, with this simple bit of kit and the right software, you can use facial recognition to keep others out of your computer and data. And the best thing is it doesn't have to cost you anything.

Windows and Mac users can use KeyLemon (www.keylemon.com/app) to unlock their computer using facial recognition for free. There are also Bronze and Gold editions too, which offer far more functionality. They cost \$19.95 and \$39.95 respectively.

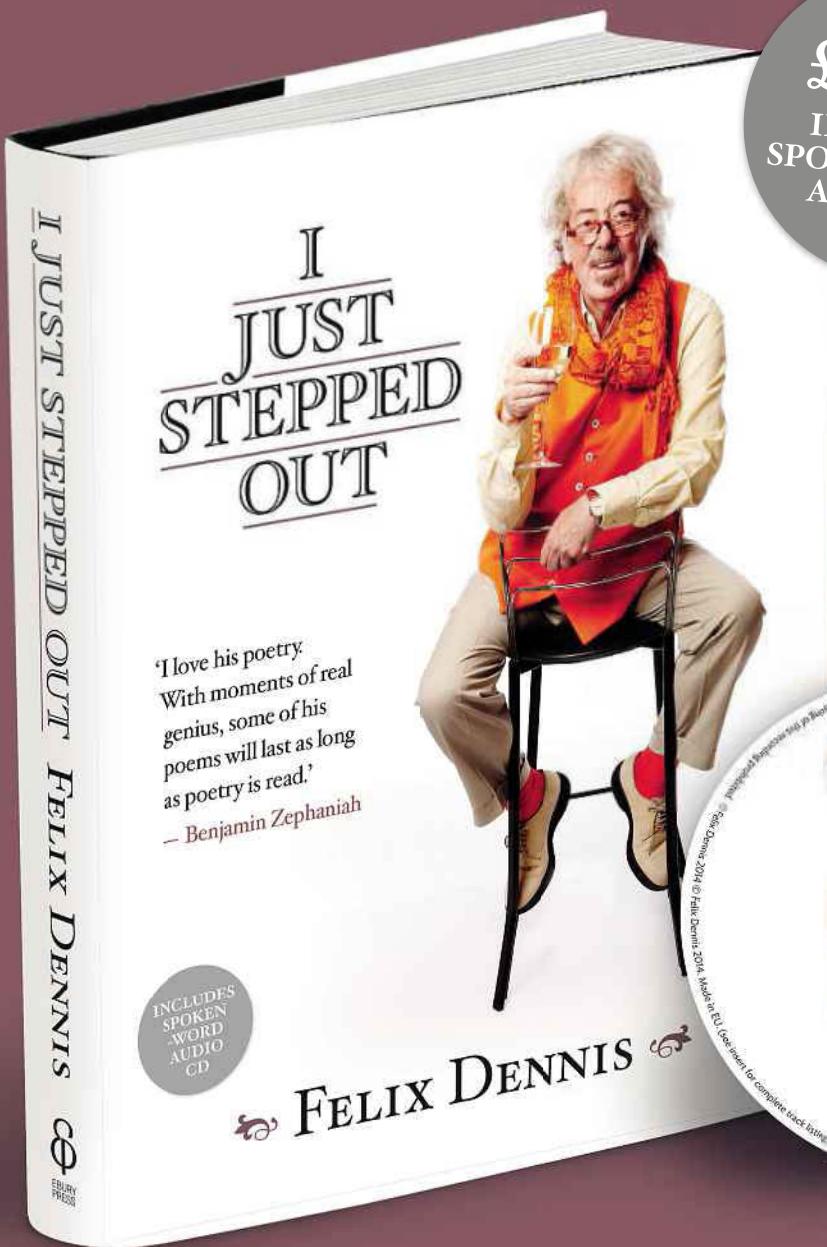
Similarly, Rohos Face Logon has a free edition and a Standard version for \$24. Again, though, the basic feature of unlocking your computer with facial recognition is included in the free version.

Fans of completely free software can try BananaScreen (bananascreen.en.softonic.com), a Windows-only application, which also unlocks your computer only when the camera can see your face.

Of course, with these and any other facial-recognition programs, there's always a chance that someone could just use a photo of your face to unlock your PC. But if you're only worried about strangers getting access to your files, then it's quite probable they won't know what you look like anyway. It might not be the most secure method of locking down your computer, but it'll do a reasonable job in everyday situations.



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Your Letters

Is Firefox Dead?

I sincerely hope Firefox is not dead. It happens to be my browser of choice, but far more important is the contribution the Mozilla Foundation in general, and Firefox in particular, has made to the open source community. I avoid Chrome (and Chromium) because Google, I'm afraid, can't be trusted. Perhaps an article about getting out from under Google would be interesting. And, if Google, like Amazon, is impossible to circumvent, what does that say about competition on the Internet? Nothing good, I fear.

“I avoid Chrome (and Chromium) because Google, I'm afraid, can't be trusted”

In the last sentence of your article on the plight of Mozilla, you state that, without Firefox, only Chrome would be cross platform. Not so. There's Opera, a Norwegian browser, which, were it not for the early mis-step of an ad-supported or paid-for version, would now have, I believe, a larger share of the browsing market. There's also now a spin-off called, Vivaldi. To be fair, though, if the writer meant open-source browsers, then they're quite correct, since both Opera and Vivaldi are, I think, closed. Not ideal.

On other matters... Do I distro-hop? Yes, I do – and I'm coping well with the condition. I've



installed on USB, run directly from CD, installed in multiple partitions (currently running Mint Rosa and Ubuntu Mate 16.04), and, of course, VirtualBoxed and otherwise emulated. Now with all the new LTS #buntus, and their derivatives...

On a serious note, Grub 2 is supposed to allow for booting directly from an ISO on the hard disk (a great feature), but I couldn't get this to work. I thought it might have something to do with having too many operating systems on my computer already.

Jason D'Allison's advice on tools to investigate USB drives (issue 1411) was very interesting, and had me looking in Synaptic for Linux equivalents. It's vital, I would have thought, to know the provenance and true size of these drives.

Keep up the good work.

John Gilles

Missing Firefox

I have been a Netscape/Mozilla/Firefox/Thunderbird user since the dawn of the WWW and I am already missing Firefox. At least, I am missing the speedy workhorse it once was. Occasionally, I find it bogs down and loads pages in fits and starts. When this happens, I fire up Chrome and continue on without the frustration. I will miss Firefox if it ceases to exist. I would like to see Firefox return to being a lean, mean, performance machine of its heyday!

Steven Cook

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Component Watch

Want to up your gaming game? Get a great mouse!

Kitting yourself out with a gaming mouse can be a costly expense, so it's important to choose the right one. From number of buttons, to weight, to optical resolution, there are a hundred different things to make sure you've picked correctly – so don't let price become something extra to worry about. We've found the best deals around for these five models of gaming mouse so that you don't have to worry about it!

Deal 1: Asus Republic of Gamers GX950

RRP: £55 / Deal Price: £44

Part of Asus' well-established, well-respected 'Republic of Gamers' line of peripherals and hardware, the GX950 is a high-precision gaming mouse with six buttons, 8200dpi sensor and five-way cable management. The selling point, though, is almost certainly the weight system, which allows you to pick and choose the weight of your mouse based on what you find most comfortable under your hand. Perfect for gamers of any ability, perfectly in keeping with Asus' existing gaming credentials, and pretty perfectly priced with this handy discount.

Where to get it: PC Development (bit.ly/1rX0x8G)



Deal 2: Gamdias ZEUS Professional

RRP: £70 / Deal Price: £35

Unlike most mice, even the more esoteric models that occupy this market niche, the ZEUS Professional stands out due to its three independently adjustable side expansion panels. They allow you to customise the device perfectly for your hand size and optimum grip position, while the laser sensor offers accuracy up to 8200dpi. A two metre cable length means there's always plenty of room to manoeuvre and, although expensive at RRP, this discount make it a bargain-priced gaming mouse. That combination means it's definitely worth looking at, even if you consider yourself little more than a casual gamer.

Where to get it: Ebuyer (bit.ly/1NYZrCD)



Deal 3: Mionix Avior 7000

RRP: £80 / Deal Price: £50

This high-end mouse has nine fully-programmable buttons, three-step in-game DPI adjustment, user-assigned LED colours and a two metre long braided cable, so you know it means business (or rather gaming). It's ambidextrous design is convenient, and you can store up to five profiles for quick recalibration based on game or user. There's also a two year manufacturer warranty.

Where to get it: Box (bit.ly/1T38mVS)



Deal 4: Logitech G700s Wireless Gaming Mouse

RRP: £80 / Deal Price: £70

The Logitech G700s is a rechargeable wireless gaming mouse with a sensor that can be adjusted to anywhere between 200dpi and 8200dpi. There are 13 controls that can be altered using the built-in Logitech Gaming Software, and its microswitches are good for up to 20 million clicks – so even heavy gamers won't wear it out! Combine all that with a fierce look and solid grippable surface, and this is one mouse we don't think you'll regret buying.

Where to get it: Currys (bit.ly/1rwgK3V)



Deal 5: Razer Naga Epic Chroma

RRP: £120 / Deal Price: £105

Probably the most expensive mouse on the market, the Razer Naga Epic Chroma is a wireless mouse with a 8400dpi laser sensor and 35MB of onboard storage for storing game profiles and software. Its built-in chroma light system means you can tweak its LEDs to any of 16.8 million colours. At full price you might justifiably expect miracles, but this deal makes it almost worth buying.

Where to get it: Laptops Direct (bit.ly/1S0LjfB)





SoundCloud Launches Subscription Service

And The Creator Of Bitcoin Is...

So now we know. We think...

The creator of the Bitcoin digital payment system has been uncovered as Craig Wright, an Australian entrepreneur who has revealed himself to several media outlets, including the BBC.

People have long wondered who the person behind bitcoin was, having previously gone under the name of Satoshi Nakamoto, and now we know. This isn't just a random claim, with Wright having given proof of his comments via digital signatures pertaining to Bitcoin's early days.

So why let the cat out of the bag now? That's all to do with the taxman. The

Australian Tax Office was reported last year as investigating Wright, and that seems to have spurred him into going public. In the BBC story, Wright said, "There are lots of stories out there that have been made up, and I don't like it hurting those people I care about... I don't want any of them to be impacted by this."

It is worth noting that despite Wright's claims being reported in the mainstream press, there remains a fair amount of scepticism over whether this is all real or not. With the jury still out, to a degree, we're just reporting the facts as we know them.



Do we really need another Spotify?

Following its launch in the US, SoundCloud has expanded its SoundCloud Go music subscription service in the UK and Ireland.

The music catalogue consists of over 125 million tracks, and the ad-free service will include offline listening for the £9.99 monthly fee (£12.99 a month

on iOS). Users of the free SoundCloud service will now have to listen to advertisements in between songs, with a proportion of the money from ad revenue going directly to the artists themselves.

Given that we already have Spotify for £9.99 a month and also Tidal if you're looking for premium audio quality (or the

new Beyoncé 'visual album'), we do wonder what kind of an impact SoundCloud Go can really have on the market.



Gopher Breaks Large Hadron Collider

Bet this hurt

So this really happened. A gopher somehow found its way into the electrical cables at Cern's Large Hadron Collider and shut the whole thing down.

You really could not make this up. The poor little creature didn't get into the actual tunnel, which is fortunate perhaps, but it didn't manage to survive the experience, sadly. Imagine if it had got into the tunnel? We wonder what the scientists would have learned from that?

The bogs at Cern said that the outage meant the particle accelerator would be down for a few days and that there has been a previous animal accident in 2009, when a bird knocked it out of action. Having spent time at the cinema watching Alvin and his chums, could someone point him in Cern's direction?



Competition is vital if we want the technology sector to remain healthy, because it tends to drive prices down and progress forward. But as Microsoft has shown recently, sometimes these rivalries can lead to us all taking a step backwards.

Do Windows users benefit from not being able to use Google with Cortana? Of course they don't, no matter what thinly veiled excuses Microsoft might offer in defence of its removal of the world's most popular search engine from its voice-activated personal assistant.

Of course, it's not the only firm engaged in such petty behaviour. You only need to look at Amazon, which refuses to sell certain Google products like the Chromecast. At the same time, you won't find any Amazon listings in your Google Shopping search results either, because Amazon refused to pay for inclusion.

Again, it's not the customers who benefit and, ultimately, it doesn't do the companies involved much good. If people want Google results, they'll bypass Cortana. If they want a Chromecast, they buy from anywhere that isn't Amazon. And if people want to go to Amazon, they will.

What do you think about all this rivalry? Write to letters@micromart.co.uk and let us know.

Anthony
Editor

Meanwhile... On The Internet...

If the name Satoshi Nakamoto is, as the vast majority of interested parties consider it to be, in fact a pseudonym, whoever's behind it may as well have opted for Keyser Söze (spoiler alert: tinyurl.com/MMnet13a). Indeed, Christopher McQuarrie's script for Bryan Singer's *The Usual Suspects* couldn't pack in all the twists and turns that Satoshi's story (tinyurl.com/MMnet13b) has managed in the eight years since they/she/he revealed their concept for a new type of currency called Bitcoin (tinyurl.com/MMnet13c).

We've covered unsuccessful attempts to identify the mysterious Nakamoto before – especially the apparent *Newsweek* screw-up that led the world's press to descend on the unsuspecting Dorian Nakamoto (tinyurl.com/MMnet13d), a 65-year old unemployed engineer living in Los Angeles, on the back of its assertions that he was the reclusive and potentially very, very wealthy Mr. N.

When further analysis of the *Newsweek* investigation established it as being based on little more than circumstantial evidence and a hurried, debatable, contested 'confession' from Nakamoto (obtained by doorstepping him), the subject of the story immediately threatened to sue the magazine. That hasn't happened yet, apparently, but it doesn't make *Newsweek*'s story any more convincing.

Dorian Nakamoto wasn't the first to come under scrutiny, and he certainly hasn't been the last. A 2011 *New Yorker* Satoshi Hunt (tinyurl.com/MMnet13e) came up with the name Michael Clear, among others, as a potential Nakamoto – a claim he was finally driven to refute in 2013 (tinyurl.com/MMnet13f).

However, to be fair, the man who is currently in the spotlight, Craig Steven Wright, has put himself there. We've reported previous claims that he may be one of the people behind the creation of Satoshi Nakamoto and Bitcoin (which came from virtually simultaneous reports in *Wired* and *Gizmodo*: tinyurl.com/MMnet13g and tinyurl.com/MMnet13h) just before Christmas last year. But the waters surrounding those investigations quickly became muddied (tinyurl.com/MMnet13i) and, short of the ongoing attention of Australia's tax authorities (tinyurl.com/MMnet13j), Wright kept his head down, and the story slipped back into the more specialised pages of finance and Bitcoin-specific publications.

Then, last week, almost out of nowhere (but not entirely, as rumours had been circulating for a while: tinyurl.com/MMnet13k), Wright gave interviews to The BBC (tinyurl.com/MMnet13l), *The Economist* (tinyurl.com/MMnet13m) and GQ (tinyurl.com/MMnet13n). Then he posted his own blog post claiming to have cryptographic proof that his claims were true (we cannot link you to this, however, for reasons that will become clear).

.AVWhy?

Videos For Your Eyes...
Not Necessarily For Your Brain

May the 4th, Star Wars Day, has come and gone with more fanfare than usual, not least because this is a great time to be a *Star Wars* fan. Among all the corporate tie-ins and cash-ins, one of the ways Disney chose to mark the day was to release a cool little video retelling the story* of *Star Wars: The Force Awakens* using some of the emojis it released in the hype-filled run-up to its release. It's a great little bit of animation that is so millennial it hurts (youtu.be/adgnlbRWo_Y).

* well, not quite all of it, actually: one big spoiler is omitted

Saying you're Satoshi Nakamoto and proving it are two very different things, however (as this extensive guide to validating such claims outlines in great detail: tinyurl.com/MMnet13o). Not only are there various technical hoops to jump through, many of which can be spoofed by a clever trickster, there are rather more empirical tests to pass among the close-knit community that was responsible for building on Bitcoin's foundations.

The initial technical steps Wright took towards proving his claims were viewed sceptically and quickly pulled apart (tinyurl.com/MMnet13p) by those with technical know-how (tinyurl.com/MMnet13q). However, his claims were simultaneously being backed up by some characters with intimate knowledge of Bitcoin's early operations – like Gavin Andresen (gavinandresen.ninja/satoshi), Jon Matonis (<http://themonetaryfuture.blogspot.co.uk/2016/05/how-i-met-satoshi.html>) and Joseph Vaughn Perling, who claims to have met Wright while he was using the pseudonym Nakamoto prior to the creation of Bitcoin (this interview with him is very interesting, and not a little creepy: tinyurl.com/MMnet13r). All of them claim to be privy to proof other than that which has been made public.

In short, it was a mess... No one could prove or disprove Wright's claims, and it's difficult to know who to believe, especially as, right now, there's a lot at stake in the world of Bitcoin.

Specifically, we're referring to a so-called 'Civil War' (tinyurl.com/MMnet13s) among the Bitcoin community, where two separate visions for the future of the cryptocurrency have been engaged in a war of words over where it's going next (let's, for the sake of space, characterise them as 'Purists' and 'Progressives'). Obviously, an intervention from a verified Satoshi Nakamoto right now would have a massive effect on the debate, so there is a lot riding on Wright's claims.

However, when pressed hard for further proof that would satiate the doubters – which, it has to be said, is a bordering on impossible and certainly a thankless task – Wright folded, and refused to provide any further evidence. He also removed his original 'I'm Nakamoto' blog and replaced it with a message that said little more than "I broke. I do not have the courage. I cannot" (tinyurl.com/MMnet13t).

Was it all a scam? Was Wright intimidated or cajoled into either claiming he was Nakamoto or backing down from those claims? Why are so many key figures in the saga still supporting his claims, even in the face of his own unwillingness to prove it? What does this all mean for the stash of Bitcoins presumed to be owned by 'Nakamoto', worth about \$450m at present (tinyurl.com/MMnet13u), and the mysterious Tulip Trust that Wright claims is holding the coins until 2020 (tinyurl.com/MMnet13v)? Who knows? Right now our heads are spinning.



Caption Competition



This large laptop (or small chap, you decide) was the subject of the caption competition in issue 1211. Here are your best offers...

- **Sawboman:** "When I switch this baby on, that lot behind goes dark."
- **Sawboman:** "Please, where can I get a laptop bag on wheels?"
- **Sawboman:** "There is never a 1,000 amp power socket when you need one."
- **BullStuff:** "The world's smallest property developer sizes up the last green space in London."
- **BullStuff:** "I use my feet for the track pad!"
- **BullStuff:** "I am looking after this laptop for my dad, here he comes now..."
- **doctoryorkie:** "Screen real estate growth predictions come true."
- **Dwynnehugh:** "The Lilliputian didn't realise that Amazon only sell full size laptops."
- **Thomas Turnbull:** "The only problem I have is that I have to connect it directly to the local Nuclear Power Station before it boots up."
- **Thomas Turnbull:** "Big is beautiful but a bit awkward to carry."
- **Mark McE:** "Due to a *bug* in the system Ant-Man was not returned to his original size"

The winner, however was The VFM Addict with "Evidence emerges of growth in the UK laptop market."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum (forum.micromart.co.uk), or email us your funnies via caption@micromart.co.uk, remembering to add the issue number to the email.



to blame?

Doom Creators Pull Kickstarter Project

Demo first, fundraising later

This is a mighty shame. When iD Software's John Romero and Adrian Carmack launched a Kickstarter project for a new first-person shooter, we and many others got all excited.

Just four days into the project launch, they pulled the funding campaign, as they said that they wanted

to first develop a gameplay demo before moving forward. *Blackroom* was going to be another shooter from the *Doom* chaps, and the decision to pull the project is a shame, because funding was already progressing well.

Hopefully, the demo won't take too long to get together, and then we can all get a look at what they're planning.

Minecraft Hack At Lifeboat

Passwords and login data possibly grabbed

Hackers just never stop, do they? The latest hacking story comes courtesy of *Minecraft* network site Lifeboat, with naughty bods having stolen login data for over seven million accounts.

Data from the hack has also found its way onto various sites online, and many of the users' passwords were not protected all that well, by

all accounts, so they were easily unscrambled by the hackers. The breach, which happened earlier this year, was uncovered by security expert Troy Hunt, who further claims that Lifeboat knew of the hack months ago but chose not to go public.

As bad as this is, it's important to point out that Lifeboat has said that it hasn't had any reports of anyone being affected yet.

Snippets!

Superfast Broadband? Apparently Not

Comparison website uSwitch has carried out a bunch of tests on over 40 UK towns and cities to see how fast average broadband speeds really were.

Twenty of the 42 locations covered have registered average speeds under the government's recommended figures for superfast connections – 24Mbps or higher – and the UK's slowest city is Hull, weighing in at an average speed of 12.4Mbps.

uSwitch has concluded from its results that barriers to taking up fibre broadband, such as pricing, could be the big problem here, as government statistics suggest that superfast broadband is now actually available to 90% of the country.

DeepMind Accessing NHS Records

This is going to make some people uncomfortable, but it transpires that Google's DeepMind AI firm has access to 1.6 million patient records from the NHS as part of a data-sharing agreement with the Royal Free NHS Trust.

The agreement was reported by the New Scientist, and while Google cannot use the data in any other part of its business, the revelation will leave many feeling uneasy about who has access to what.

DeepMind has made it clear that its role with this data is to support doctors in making their decisions.

Woman's Fingerprint Ordered In US

A report in America has detailed that a woman in California has been ordered to provide a fingerprint in order to unlock an iPhone that was seized by the authorities.

The phone belongs to the girlfriend of a gang member. The reason this is controversial is because forcing someone to provide biometric data that could possibly incriminate themselves could be in breach of America's Fifth Amendment.

Microsoft Forces Bing Search With Cortana

Microsoft is 'Protecting' the search experience

Microsoft has written a blog post confirming that it's forcing people to use its Bing search engine when they use Cortana in Windows 10.

The blog post points out that the reason behind the decision is because some search providers were not designed to work with Cortana. "The only way we can confidently deliver this personalised, end-to-end search experience is through the

integration of Cortana, Microsoft Edge and Bing – all designed to do more for you".

It goes on to point out in big, bold letters that you can "of course" carry on using whichever search engine you like within Windows 10... just not with Cortana. Clearly, taking this stance is one sure way of locking users into its products, and Microsoft has every right to do this. We can't imagine it will sit well with everyone, though.



Amazon's In-App Charging Ruled Illegal

US case goes against firm

A US judge has ruled that Amazon has illegally charged parents for in-app purchases over a period of years.

The in-app purchases relate to the period between 2011 and 2014, and this case was brought forward by the Federal Trade Commission in 2014 when it sued Amazon over billing parents for unauthorised in-app purchases made by children.

The FTC was seeking refunds for all affected Amazon users and also a permanent ban for the company from billing parents and account holders for in-app purchases without their consent. The judge in the case ruled that Amazon didn't provide sufficient information about in-app charges within

what were labelled 'free' apps, thus holding it accountable.

Amazon could actually have settled with the FTC in 2014, and this is precisely what both Apple and Google did, but because it chose not to, it led to this legal action. If the FTC is successful in its ultimate aim to get full refunds back to all those affected by this, Amazon could be faced with a big bill.



Next Year For Nintendo's NX

Next-gen console later than expected

Nintendo held an earnings briefing during April, which could have been very boring. However, the company dropped in an update on the release of its next console, known as NX, to liven things up.

The NX console is now launching in March 2017, which is a little later than the Christmas deadline that had been expected initially. The console won't be getting an early viewing at this year's E3 either, with focus there turning to the next game in the *Zelda* series.

Little is known about the NX, and because this was simply cited in a financial statement, it didn't give anything else away, so we wait like the rest of you for more details. It's obvious to everyone that Nintendo needs this to be more successful than the Wii U, though. As for that earnings briefing, the firm's annual net profit fell by over 60%. Ouch.

Mayer Would Bag \$55m If Fired

Not a bad payout...

As speculation surrounding the future of Yahoo continues following its announcement that it wants to sell its core assets, details of any possible severance pay for executives who lose their roles should any sale go ahead have been revealed.

The details surrounding this data have come from an SEC filing, and for Marissa Mayer, we're talking big money. Really big money. Mayer would stand to receive \$54.8m in stock and cash and while she is hardly

going to be happy if she did lose her job at the top, a payout this big would surely help ease the pain.

Aside from Mayer's personal feelings on her future, several investors would no doubt be happy to see her leave given Yahoo's relatively poor financial performance in recent years.



software problems were to blame for their failure to take off

Windows 95 Runs On Apple Watch

Why? Because it can

Nick Lee should be very pleased with himself. The partner at a mobile product design studio in Brooklyn has blogged that he has succeeded in installing Windows 95 on an Apple watch.

Mr Lee blogged at [medium.com](#) that because the Apple Watch has a fair bit of grunt behind the case (a 520MHz processor, 512MB of RAM and 8GB storage), it should be more than capable of handling Windows 95. Lee had to use an x86 emulator on the watch in order to run Windows 95, and

he's posted video evidence of the project's success.

We say success, but the boot time takes an hour because of the emulation, and it's hardly a usable version of the OS. Still, well done chap.



German City Trials Traffic Signals For Smartphone Users

Strange but true

We hadn't heard of Augsburg before, but the German city has written itself into the history books, of sorts, by trialling a novel method of traffic signals specifically for smartphone-obsessed pedestrians.

The city has placed LED lights into the actual paths at pedestrian crossings that flash red when it isn't safe to cross. As the lights are actually in the path itself, mobile users that are

heads-down and engrossed in their mobile conversations don't have any excuse to walk out into busy traffic. The decision was reportedly made after a teenager was killed when struck by a train while looking at her phone.

This is arguably a neater idea than China's smartphone lanes for pedestrians that we've reported in the past, although it's sad to think that smartphone users are so engrossed that measures like this even need to be considered.

Element Gaming Palladium Keyboard

There's nothing toxic about this heavy metal peripheral

DETAILS

- Price: £39.99 (£19.98 from Ebuyer)
- Manufacturer: Element Gaming
- Website: goo.gl/wgWjXk
- Requirements: Windows XP or later, Mac OS X, spare USB port



The Palladium gaming keyboard is a mid-range peripheral sitting neatly between the entry-level Thorium and higher-end Beryllium mechanical keyboard from Element Gaming.

Although the Palladium is a membrane keyboard, it does offer something slightly different from the competition in terms of its design, feature set and price.

The Palladium is quite an astonishing-looking keyboard. The dominating feature is a large aluminium plate that extends beyond the rear of the actual keyboard into a sharp lined symmetrical pattern. The plate is screwed onto a white plastic base, but each key is raised above the plate to the height of around 5mm, with the solid keys extending a further 10mm beyond that. Effectively, the tops of the keycaps are raised to 15mm off the base of the keyboard, which makes cleaning the keyboard a lot easier but also increases the travel somewhat.

Each keycap is an injection-moulded affair, with an LED. There are 19 anti-ghosting keys set up for gaming and a ten million keystroke lifetime. The LEDs can be arranged in seven different colours and can also



66 The Palladium does appear to be able to take its fair share of abuse 99

be set to pulsate between colours or just remain static.

It's quite a unique design, but using the Palladium takes a little getting used to. We've often said that it's how a keyboard 'feels' that makes one model better than the next. While the Palladium does feel very good to use, we don't like the fact the Return key is single height, so you inevitably end up hitting

the hash key above it. It's just a matter of getting used to it, but the keys do work well despite the travel we mentioned earlier.

On a more positive note, the heavy base means the Palladium doesn't move while in use, and it forms a solid backbone that improves its rigidity. Although it doesn't boast the extended lifespan of its mechanical counterparts,

▲ Element Gaming's Palladium keyboard, complete with raised keys and aluminium frame

◀ The design is great and high quality too

the Palladium does appear to be able to take its fair share of abuse. This is mainly due to the high quality of the components, including a braided USB cable.

If you're in the market for a high-quality keyboard that's a little different in terms of design, then you can't go far wrong with the Element Gaming Palladium.

mm David Hayward

A good keyboard, with a unique design and feature set



Magix Audio and Music Cleaning Lab Premium

Is this the ultimate sound and music editor?

DETAILS

- Price: £ 69.99
- Manufacturer: Magix
- Website: www.magix.com/uk
- Requirements: 1GHz CPU, 2GB of RAM, 1GB disk space, Windows Vista or later



▲ Lots of cleaning options including VST 2 professional studio effects



A few weeks ago, I reviewed the Video Audio Cleaning Lab from Magix, designed to fix and enhance any problems you have with your video sounds. Well, this latest product is the big brother of that package, so it's quite capable of fixing the same problems, yet it can also handle a whole lot more as well. The name of the product on review is the Magix Audio and Music Cleaning Lab Premium. The Premium tag indicates that it's the top of the range in this series, and one that includes some very sophisticated sound editing features.

The interface is quite similar to the previous product, which seems to be the format that's evolved to become the common layout for sound editors, where the screen is split into two primary sections. As usual, this shows the sound waveforms running across the top, with the editing tools arranged along the bottom. From here, the general arrangement has your five primary options on the left, the dialogues and menus for the individual effects in the centre and the information and visual analysers on the right. If you're editing video sound, you can also open a video preview

window in the lower-right quadrant as well. You do have limited control over the layout, but only in terms of the proportions of the top and bottom of the screen. Alternatively, you can expand the area you're working on using one of three preset function keys. The interface is fully context aware, so the display automatically changes to reflect both the primary option and, of course, the editing function you're currently using.

Import options include CD, vinyl, cassette, speech, digital and web radio. All of these can be monitored and any adjustments can be made while you're recording. And in the case of web radio, the program lists over 6,000 stations you can record directly from.

To say it's comprehensive is something of an understatement, because it has every conceivable filter and effect you could want. These range from simply removing clicks or background hiss, to adding reverberation and optimising speech recordings. Incidentally, these are just a couple of examples from the huge catalogue available to you.

But you needn't feel overwhelmed by this, because in the majority of cases there are presets (over 350) you can use. There's also a global auto clean option that analyses the project or a selected portion of it, then offers a one-click solution to fix what it calculates is wrong. Most of the time where you're trying to get rid of extraneous noise or crisp up the whole performance, it works quite well. However, I found the auto option could be a little conservative in its solutions, which to be honest would be the preferred choice anyway. Luckily the same interface provides options to tweak the results a little further if necessary, rather than having to backpedal every time. The system also includes six professional studio effects, together with a (Virtual Studio Technology) VST 2 interface that allows you to add your own VST compatible plug-ins.

Once you've completed the editing, you would normally move to the mastering option to optimise the project for final output. This follows a similar path to editing, yet in this case you have a range of preset styles

to add to your project. Styles basically change the tonal quality to match the type of music or, in the case of speech, the appropriate venue. So you could create a 50s big band or 70s disco sound with a single click.

There are also export options for all the major file formats, including video. And you can create your own CD track layouts, add new or change the meta data or upload directly to the most popular social media and storage solutions.

All in all, an excellent program, which also won't break the bank.

mm Joe Lavery

Easy to use yet very comprehensive



HP PageWide Pro 477dw Multi-Function Printer

HP takes inkjet printing and drags it screaming into this decade

DETAILS

- Price: £434.21 (Ebuyer)
- Manufacturer: HP
- Website: www.hp.com
- Requirements: Windows PC or Mac, Android or iOS device



Using inkjet technology for multi-function printers isn't very cost effective, even if people like the quality of the output.

Up till now the answer was laser or wax thermal printing, though both have corresponding limitations in colour representation, speed and cost. What people needed was inkjet-like results but laser speed and post of ownership, if those aren't mutually exclusive demands.

HP's new PageWide Pro 477dw brings the usual scope of multi-function features and looks

like a laser printer, but instead it uses a new inkjet technology called 'PageWide'.

The radical concept this introduces is a fixed 'page wide' head with no less than 42,240

nozzles delivering individual drops of just eight picolitres at ten metres per second.

Printing at 1200dpi, and the system uses a four-cartridge CYMK model, and the swath of

it replaces, the PageWide Pro MFP 477dw is faster at printing and scanning, can accept higher yield cartridges and works with JetAdvantage Security Manager.

They're both designed to be low-volume business printers (4,500 or less pages a month), but the 477dw is perfect for those with a more mature IT infrastructure.

While the standard duty cycle might seem low, the maximum duty cycle for the printer is a whopping 50,000 pages a month.

With most inkjets, that number wouldn't be achievable, but using 55pm GO 'General Office' mode, it would take just 81 minutes to spew 4,500 5% coverage pages out. The '974X' spec cartridges are rated for roughly 10,000 black pages at the usual 5% coverage, and 7,000 pages for the HP 973X colour ones. As you might have guessed already, it doesn't come with the high yield carts, but

Features

- 50-sheet single-pass, two-sided automatic document feeder (ADF).
- Intuitive 10.9 cm colour touchscreen with gesturing.
- Easy-access USB port.
- NFC touch-to-print.
- Front door access to easy-to-replace print cartridges.
- 50-sheet multipurpose tray with long paper extension.
- 500-sheet main input tray.
- Legal-size flatbed scanner.
- 300-sheet output bin.
- Paper/supplies storage area.
- Integrated wireless networking.
- Built-in automatic two-sided printing.
- Hi-speed USB 2.0 port (for connecting third-party devices).
- Hi-speed USB 2.0 printing port.
- Ethernet network port, 10/100 Base-TX.
- Fax connection ports.

66 It works out at less than a penny for a mono page and about 3p for a colour one 99

the output is 217.8 mm (8.575 inches) wide, handling the width of both US Legal, Letter A and European A4.

So far, this tech has only been available on some of the Officejet Pro and Officejet Enterprise printers, but the new HP PageWide Pro MFP 477dw now swells their ranks.

Compared with the HP Officejet Pro X476dw MFP that

the 'A' variety that instead offer 3,000 black and 1,500 colour pages respectively.

High yield carts cost roughly £80-85 each to buy. That might seem on the steep side, but it works out at less than a penny for a mono page and about 3p for a colour one, which is generally less than a colour laser. That makes it substantially more frugal than many inkjets and



faster, plus it produces higher quality output than most lasers.

The only reservations I have about the print technology is that recently printed plain paper arrives a little damp and warped. This soon passes, but it's not the same dry/warm handling experience of laser output.

If you've owned HP laser printers before, you'll expect the

high build quality on offer here. This unit is built like something used for mining the Klondike, and it's generally a pleasing fusion of form and function.

The new page wide technology also produces less noise and emissions than laser, and the printer doesn't induce a swaying motion in any table that isn't perfectly rigid.

Paper handling is a single 500-sheet bin and a manual side loading tray, although HP accessories with an additional single 500-sheet tray and dual 500-sheet bins incorporating a floor stand. The only downside I can see with either of these options is that the output platform can only handle about 300 pages, so any print run greater than that number would always involve manual intervention.

However, there are some aspects to this design you need to be warned about. For a start, at 51 pounds (23kg) this is a heavy old beast. Those with a history of back problems, you've been warned!

Also, don't assume that getting it ready to print will take minutes. Not only did HP apply more adhesive tape to this printer than any other I've seen, but the setup routine prints no less than eight pages, some with 50% ink coverage. Once through those hoops, and once you've set the networking up, either with a cable or wi-fi password, then you're good to go.

A definite treat is the scale of the colour touch panel,

because it allows the printer to play videos to you to explain a feature or process.

At the top level, the touch menu allows you to initiate the usual copy/scan/fax functions, along with print from and scan to USB. If you dig deeper into the menu structure, you can do all manner of things like scanning to network folders or SharePoint, in a very friendly big IT-friendly way.

Overall, for those who want colour output for a team of ten people or less, this is an excellent choice and a much better option than a colour laser.

mm Mark Pickavance

Office printer with impressive new Pagewide inkjet technology



Synology DiskStation DS216j

Synology delivers a new j series NAS box for the discerning user

DETAILS

- Price: £126
- Manufacturer: Synology
- Website: www.synology.com
- Requirements: Wired network, broadband router

I really liked the DS215j, and so I would have been rather shocked to have spurned the DS216j given that it's remarkably similar in almost every respect. The outside is almost identical, being a minimalist exercise in high quality plastic and form-is-functionality. Synology has been using this dual-drive design for a while and evidently sees no compelling reason to change it now.

Exactly like its predecessor, this is a NAS box for two SATA drives (not provided), making them available to a network in an effective and robust fashion.

All connections are at the rear, those being gigabit Ethernet, two USB ports and the external power block. At the front are the power button and some activity lights, and nothing else remotely superfluous. Synology's mantra here is to provide simple and reliable hardware, with all the frilly bits in the software where



it's more easily updated and enhanced.

Compared to the DS215j, there are some generally modest improvements without any radical departures.

The 800MHz Marvell Armada 375 88F6720 has been upgraded to a 1GHz Marvell Armada 385 88F6820, both being dual-core.

RAM remains unchanged, being 512MB of DDR3 that's not upgradable, as it's soldered on to the system board. Whereas on the DS215j one of the USB ports was USB 2.0, here they're both USB 3.0. That's useful if you use those ports with an external drive to expand the possible 16TB (2x 8TB) internal capacity, but probably less critical if you hang a printer off one.

The extra CPU power translates into roughly 10% better write speed and 1% better read speed, and it makes the system marginally more responsive when using the web interface.

Performance is about as good as the bandwidth of a gigabit Ethernet allows without using channel bonding: roughly 110MB/s read and 95MB/s write speed. However, to get those speeds you'll need a pair of matched NAS-specified drives, like the two 2TB WD REDs I used for my testing.

You can use any 3.5" or 2.5" SATA drives in the DS216j – even SSDs if you've feeling flush. They can be configured either in redundant mirror, striped performance or as independent volumes depending on your preference. Using stripe and

Features

- A versatile personal cloud storage for everyday life.
- Dual-core CPU with hardware encryption engine.
- Over 112.75MB/s reading, 97.6MB/s writing.
- Easy-to-use web operating system on any browsers.
- Everywhere access with iOS/Android/Windows apps.



mirror effectively dictates that the drive are the same size. You can also put a single drive in to start and add another later when you've got the money, and Synology's DSM can then upgrade that system

wanting to centralise security camera captures.

What it's not really up to is real-time video transcoding or handling lots of simultaneous users. Those who want to do those specific jobs will need

so small (generally a fiver) that you'd be advised to splash out on the DS216j anyway.

You can buy a dual NAS box for less, like the excellent ZyXEL Person Cloud I covered recently. But what you pay a small amount extra for with Synology is not just build quality; it's the very polished DSM operating system and the big collection of installable apps it supports. I counted 37 Synology created apps and 39 third-party modules and that's more than my aging DS411 has available.

There's a maturity to Synology's solution that others struggle to match, making it the undisputed market leader in this home/small business NAS sector. The Synology DSM trumps other NAS brands, and the performance of the DS216j is dramatically better than its own entry-level DS216se (256MB RAM).

Normally in those circumstances I'd direct you to its cheaper predecessor, though the price difference is

be redirected to fulfil those requirements. For those who just want a fire-and-forget NAS, there are plenty around, but if you want something that can do more, the DS216j is an excellent choice.

mm Mark Pickavance

An affordable performance NAS for home and small office use



to use redundancy through its hybrid RAID technology, should you want that.

The amount of RAM limits how many of the Synology DSM apps you can realistically use on this platform, but then that's why it makes the DS216Play and DS216+ models with twice as much. That said, the DS216j has enough memory and processing power to handle the typical load-out for most home users and anyone

to invest more than this, realistically.

What I accepted early on was that however you look at the DS216j, this design isn't a major revamp; it's just the DS215j with a few new bells on. It's obvious that Synology wanted a new product but isn't in the business of competing with itself.

Normally in those circumstances I'd direct you to its cheaper predecessor, though the price difference is

Archos 70 Platinum

An inexpensive device with a great display

DETAILS

- Price: £60
- Manufacturer: Archos
- Website: goo.gl/tPMzcm
- Requirements: Google account

The 7" tablet market has grown significantly in recent months, with users much preferring more manageable devices, rather than something that's 10 inches or more.

Archos has risen to that demand and produced an interesting range of 7" Android tablets, from the GamePad through to the top-of-the range 70b Helium. This Archos 70 Platinum comes in second to the Helium, so you can expect some pretty decent specifications.

It features a quad-core Mediatek MT8127 1.3GHz A7 processor with a Mali 450 GPU and 1GB of memory. You get 16GB of storage, Android 5.0 and a micro-SD card slot to push up the available storage.

The display is an excellent 7" 1024 x 600, IPS five-point capacitive touchscreen that offers a remarkably clear and colourful output. Along the sides we have the power and volume buttons and a micro-USB port for charging. Sadly, there's no mini-HDMI, but that's not unusual at this kind of price.

The 2MP rear camera will provide reasonable photos and video recording. The front facing 0.3MP camera won't win any resolution awards, but for video calling it'll work fine.

The Platinum is a fairly svelte device, measuring just 188 x



▲ The Archos 70 Platinum, with a clear and colourful IPS display



▲ It's ideal for a number of uses

108 x 10.4mm and weighing 270g. As an everyday tablet, it's ideal and can be chuck into a jacket pocket or bag without too much fuss. Likewise as an e-reader, the

and Moto X, both of which are fairly good devices. It's also about half the performance of a Samsung Galaxy Note 4 – which is obviously a much more expensive device.

World of Goo demo, all of which can be removed without too much difficulty.

The Archos 70 Platinum is a good 7" tablet. Its performance is generally above average, the screen is excellent and the price isn't too bad either.

mm David Hayward

66 Very little has been added to Lollipop that has the Archos stamp on it 99

Platinum can be held comfortably for quite some time before it becomes too heavy for a finger tip grip.

In terms of performance, the Platinum is reasonably good. Our GeekBench 3 single-core score was 362, while the multi-core score test was 1,211. This puts it on a performance par with the likes of the Motorola Droid Ultra

We've always liked the fact that Archos tends not to bundle tons of useless apps on any of its Android devices, and this again is true with the Platinum. Very little has been added to Lollipop that has the Archos stamp on it; there's a media player and that's it. But you'll also find *Angry Birds*, BitDefender Anti-Virus, Jamendo, News Republic and a

A good all-round tablet with a great display



Magix Video Pro X8

Magix update its top-of-the-range video editor

DETAILS

- Price: Video Pro X8 £349.00
- Manufacturer: Magix
- Website: www.magix.com/uk
- Minimum Requirements: Dual-core 2.4GHz CPU, 2GB RAM, 2GB disk space, Windows 7 or later (64-bit)



▲ The main interface and sound editing desk.



▲ You can also create DVD or Blu-ray menus.

VideoPro X8 is the latest version of Magix professional video editing suite. Admittedly it's a product with a fairly hefty price, yet as our American cousins would say, it provides a lot of bang for your buck.

And for those that simply dabble with video editing or only throw together the odd celebratory slideshow, Magix offers a comprehensive range of more affordable alternatives. But make no mistake: Pro X offers as much as, if not more than, many professional editing suites, which could cost you five times as much.

Since I reviewed the last version of Video Pro X, Magix has added a 365 logo to the box, which I initially thought indicated that you could only use it for 12 months. As it happens, it simply means you have free updates for 365 days.

The interface consists of four areas, with dual monitors for the project preview and any live or pre-recorded input. There's also an arranger (which is basically a time line), where the actual editing takes place, and finally a media pool and current project folder. However, the orientation of these areas is not set in stone; you can close, resize and organise them to suit your application. You can also save your favourite arrangements or

press 'reset to standard' if you get them in a pickle.

New to this release is Shot Match, a really useful feature that analyses two video clips for their video characteristics and will apply one to the other. This means that shots taken in different circumstances, like weather conditions and lighting, can be better matched for their tonal qualities, naturally giving the video a better flow.

Magix has also added support for 360° (panoramic) video cameras as part of the effects menu in the media pool. It can handle different types of panoramas, both spherical and cylindrical; not many products have the facility to edit these formats. Incidentally if you don't have a panoramic camera, you can create this effect with a still

camera, using key frames and a series of images, but this doesn't create a truly spherical panorama.

Other features include a range of colour, gradient and spotlight effects from the 'NewBlue Looks' collection, and you also have the ability to use OpenFX standard plug-ins directly from the Mediapool. Import options already catered for dozens of different formats, but this version now supports Intel HEVC/H.265 decoding, which is a highly efficient video compression standard. The caveat is that it takes much more processing power to use. The good news is that all the latest generation of Intel processors have hardware-accelerated HEVC encoding and decoding built in.

The wide range of features included with Pro X is not

indicative of its usability, because it's not the least bit complex to use. For example, you can import your video clips directly from your camera or from files you've previously saved to your hard drive. It automatically recognises scenes and splits them into clips for you. Clicking on one of your clips will display it in the right-hand monitor; here you can set the start and end points and drag the edited portion directly into the timeline. You continue in this way, assembling the clips that will eventually make up your finished video.

HD video files can be pretty big and can easily bring a powerful PC to its knees. Pro X gets around this problem by using 'proxy files', which are basically low resolution versions of your original footage. These are created automatically and allow easier and more fluid editing. It's only when you've completed your editing that the changes are applied to the full-resolution video.

Magix is never stingy when it comes to content, and this version is no different. The added content is over 6GB, with transitions, intros/outros, movie themes and other genuinely useful elements. What more could you possibly ask for?

mm Joe Lavery

Better than ever



GROUP TEST

4K Displays

4K is the next big thing, whether you like it or not. While many of us are still getting used to having a 1080p display, there are some who have taken the plunge and opted for a resolution that has eight million pixels compared to just two million.

We have six displays on test, to see which offer finer detail, greater texture and more features.

4K Displays

Acer CB280HK

DETAILS

- Price: £290
- Manufacturer: Acer
- Website: goo.gl/WWtly6
- Requirements: GPU capable of displaying up to 4K resolutions

Acer was, surprisingly, one of the first monitor manufacturers to leap into the whole '4K on your desktop' thing with both feet. Although the Acer CB280HK is, by these days comparison, a first-generation model, it's still available to buy and can still hold its own in a now-overcrowded market.

The Acer CB280HK is a 28" twisted nematic film (TN) panel LED 4K monitor capable of displaying resolutions up to 3840 x 2160. If that wasn't enough to pique your interest, then the 1ms response time, 100,000,000:1 contrast ratio, DVI, HDMI, DisplayPort and mini-DisplayPort may tantalise you even further.

It's surprisingly ergonomic too, with adjustable height and tilt angles, plus there's a Mobile High Definition Link (MHL) on one of the connections so you can hook up your phone and enjoy the

new generation office-in-your-pocket; of course, with the added bonus of having a large ultra-HD screen.

The quality throughout is generally good. The relatively large bezel was a little off-putting to begin with, but that soon became a background annoyance that was easier to ignore the more we used it. The base, however, didn't feel all that good; it did the job it was designed for well enough, but it did feel a little flimsy and perhaps a little too cheap if we're going to be fussy about the details. Saying that, there were no creaks and cracks and sounds of plastic under great stress as we moved the screen around its tilt and height adjustments.

As you would expect, the screen quality is what will ultimately draw in the crowds. 4K may well often be blasted as an unnecessary technology, but once you've experienced true 4K viewing and gaming, you can begin to appreciate just how amazing it really looks. Sadly, though, we found the Acer CB280HK a little washed out in that department.

The colours were good, probably better than anything we've viewed in 1080p HD. But when next to the other 4K monitors we've had on test,



this Acer just didn't quite hit the mark. That's not to say the clarity and sharpness of the screen was poor, but it wasn't as good as the other monitors we've used in the past.

If this happened to be the only 4K monitor you'd ever seen, and you'd upgraded from a HD model, then you would probably love the extra resolution it offers and be very impressed with the upgrade. If, however, you're used to what other 4K models can offer in terms of the depth of the colours, the contrast between the blacks and greys and the stark sharpness of the image, then you would quickly find the Acer somewhat lacking.

So while the Acer CB280HK isn't the best 4K monitor we've ever had the privilege of testing, it is okay. It would certainly suit a newcomer to the 4K display world – and their bank manager too. That's because Acer gets bonus points for the pricing; £290 isn't too bad at all. However, if you're willing to spend more, you'll find significantly better options.



▲ The Acer CB280HK is a cheap 4K monitor, but that doesn't make it the best buy

▲ Although good, we've seen a better quality image on other models

AOC U2868PQU

DETAILS

- Price: £395
- Manufacturer: AOC
- Website: goo.gl/WkNE8z
- Requirements: GPU capable of displaying 4K resolutions, DisplayPort cable needed (only comes supplied with HDMI)



▲ The AOC U2868PQU is a surprisingly good 4K display



▲ Screen quality is great, but it's certainly not cheap

AOC shares many similarities with Acer. Generally, both companies offer excellent value for money, while still adopting the latest technologies as best they can for those on a budget. Their respective products often also display roughly the same level of quality.

The AOC U2868PQU therefore was expected to be much the same as the Acer CB280HK. Specifically: good, but not the best 4K, and decently built, but not quite as high a quality as you expect from a more expensive solution. Happily, though, we were quite, quite wrong.

The AOC U2868PQU is a 28" TN panel, with 3840 x 2160 resolutions, at a smooth 60Hz and a 1ms response time. It's from the Pro-Line range of AOC monitors, so there's an inherent business-like range of ergonomics already incorporated into it. This, of course, means height adjustment, as well as pivot and swivel features to help you get that perfect position. There are four USB ports, two of which are USB 3.0 and fast charge-enabled, all set up in a side-accessed hub on the panel itself.

Connectivity comes in the form of HDMI, DVI, VGA and DisplayPort, with MHL over

the HDMI port to mirror mobile content. There's a set of 3W speakers built-in to the monitor. Although they might be a little too tinny for avid audiophiles, they aren't all that bad.

colours, sharpness and clarity are all exceptional.

Our gaming tests left us with a very good impression, as did watching UHD 4K content. Even performing normal day-to-day office

66 Has a range of useful real-world features and is soundly constructed too 99

Build quality is excellent. Whatever concerns we had over the quality, being roughly the same as the Acer model, were soon quashed. The base, stand and panel are all well constructed, and it was easy to manoeuvre the screen while still keeping it stable.

The base contrast ratio is 1000:1, and in this case the dynamic ratio hits a decent 80,000,000:1, which is enough to produce a high level of detail in both brighter and darker images. The

duties was an impressive advertisement for making the upgrade. The built-in speakers helped too, and although they're not as good as a decent desktop setup, they did a better than average job of belting out the throaty roar of a Spitfire while in our gaming test.

We were quite impressed with the AOC U2868PQU. It's a very good 4K monitor that's nicely designed, has a range of useful real-world features and is soundly constructed too. The

price, however, stings bit. At over £100 more than the Acer, it's quite a lot to fork out for a single screen – even one that's 4K with a good overall design.

However, if quality was a priority (and, frankly, if you're upgrading to 4K, it probably is) and we had the budget available, looking at the Acer and the AOC model side-by-side, we'd probably opt for this monitor despite the higher cost. Not least because you can see exactly what you're paying the extra money for.



4K Displays

BenQ BL2711U

DETAILS

- Price: £450
- Manufacturer: BenQ
- Website: goo.gl/gL3NXV
- Requirements: GPU capable of 4K resolutions, HDMI cable only in the packaging

The BenQ BL2711U is a professional CAD, 27" UHD IPS LED panel with an abundance of features for those who demand the highest possible quality when producing their work.

It can easily handle 4K resolutions up to 3840 x 2160 and, thanks to the AHVA (Advanced Hyper-Viewing Angle) panel, you'll get excellent 178° viewing angles and extraordinary colour and clarity through the use of 100% sRGB and Ultra-Vivid technologies. Native contrast is 1000:1 with a dynamic contrast of 20,000,000:1, and you get the same BenQ Flicker-Free Technology and low Blue-Light modes as from the gaming range of monitors. There's also the 10-level brightness adjustment present, again from the gaming world, which can reveal a lot more detail in darker areas.

There's an ambient light sensor located under the panel in the centre of the bottom bezel to auto-adjust the brightness of the backlight, and an Eco-Sensor that will auto-reduce the brightness if it senses that there's no user in front of the screen. Furthermore, there's PiP (picture in picture) and PbP (picture by picture) modes, as well as a range of presets that offer the best possible displays for CAD/CAM, animation, photo and video editing.

Connectivity is good too, with a pair of HDMI ports (1.4 and 2.0 ports), DVI-D and DisplayPort.



▲ The BenQ BL2711U is certainly a very capable 4K monitor



▲ However, it's rather expensive

we've experienced with other displays.

First and foremost, though, it's a professional model, so it's fairly natural that the pricing structure is slightly different. As it stands the BenQ BL2711U costs in the region of £450, but what you get in return is a fantastic monitor. However, it's still a lot of money to spend on a single screen.

In the end, it all depends on what you want from a 4K monitor: amazing build quality, screen and a more professional and ergonomic aspect or something that's slightly cheaper but still sufficient?

66 It's a professional model, so it's fairly natural that the pricing is slightly different 99

There's also a USB 3.0 hub with two ports on the underside of the screen around the back and a further two USB 3.0 ports located on the side of the screen. There's a good sized cable tidy hole on the stand and a headphone stand that pokes out of the back.

With this being a professional monitor, the ergonomics are generally better than what we've already looked at from the Acer and AOC models. The BL2711U has a 90° pivot, -5° to +20° tilt, 45° swivel and is height adjustable to 140mm, with a

maximum distance of 150mm from the bottom of the screen to the base. Interestingly, with the Display Pilot Software installed, the display will auto-pivot when the physical screen is moved for the best view when either landscape or portrait.

The quality of the display is magnificent. The range of colours, clarity and sharpness of the screen is by far one of the best we've ever seen. Of course, the 4K resolutions help with the quality of the display, but there's a deeper colour range here than



Dell P2415Q

DETAILS

- Price: £400
- Manufacturer: Dell
- Website: goo.gl/m7JaH5
- Requirements: GPU capable of handling 4K resolutions, both HDMI and DisplayPorts cables needed as nothing supplied

Dell was one of the first companies to launch a 4K monitor on the eager, early adopting, crowd with its UP2414Q. Since then, the company has ditched the UP2414Q in favour of a newer model, the P2415Q.

The Dell P2415Q is a 23.8" IPS based LCD panel, with a maximum resolution of 3840 x 2160 and 8ms response time. The typical contrast ratio is 1000:1, with a dynamic ratio of just 2,000,000:1, which seems rather small for a 4K screen.

What it may lack in contrast numbers it makes up for in connectivity, however. There's HDMI, mini DisplayPort, DisplayPort (full sized) and a four-port USB 3.0 hub, one of which is fast-charge enabled.

An odd design choice is that the HDMI port is only version 1.4, not the usual 2.0. This means of course that you'll only be able to achieve UHD 4K resolutions via the HDMI port at 30Hz, instead of the usual 60Hz that most 4K monitors offer.

This model is comes from the business-oriented line of Dell monitors so, as you would expect, there are a good set of ergonomic features. The tilt, height and pivot adjustments all work well, and moving the monitor around its angles proved to be perfectly fine, as did the rest of the construction.



▲ The familiar sight of a Dell monitor



Dell has a particular formula for how a monitor looks, and this sticks to it, meaning the P2415Q looks pretty much like every other Dell business monitor going. It also means that the same design problems apply. For example, why does it insist on positioning the ports, including the USB hub ports, in reverse and up and under the bottom of the panel? This makes it extremely awkward to plug or unplug anything, as you are required to pull the screen to one side and tilt it to see where you're going. If you have a few cables plugged in and the

power is limited by the desk and the one opposite, as in most offices, then things can get a little fraught.

As for the image quality, we weren't all that impressed. The 4K resolution looked great as a static image, but with moving images (games, movies, 4K YouTube clips and so on), there was a serious amount of lag, and the screen suffered greatly as a result. We also noticed significant screen tearing and some pixelisation around the edges of the image. There seemed to be some pretty terrible backlight bleed too.

◀ Considering the amount you're paying, you don't get a very good monitor in return

Although refined somewhat from the previous version, sadly we don't think this model is worth £400.



4K Displays

Philips Brilliance 288P6

DETAILS

- Price: £350
- Manufacturer: Philips
- Website: goo.gl/xBgYhU
- Requirements: GPU capable of hitting 4K resolutions, Only a VGA cable supplied so you'll need HDMI or DisplayPort

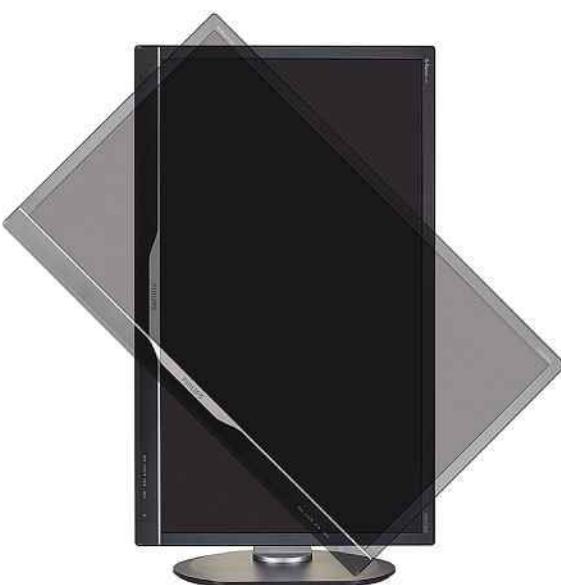


The Philips P-line of monitors caters for professional and workplace environments. CAD, picture and video editing and other such uses are the order of the day here, but does this display have what it takes to beat the competition?

This is a 28", W-LED backlit, TN panel with a maximum resolution of 3840 x 2160 and a Smart Response time of 1ms. It has a 50,000,000:1 contrast ratio, 300cd/m² brightness rating and support for 1.07 billion colours. The connectivity on the Philips 288P6 is excellent, with VGA, DVI, DisplayPort and HDMI/MHL-HDMI for the video inputs. Plus there are four USB ports (two of which are USB 3.0 with fast charging), PC audio in and headphone out.

There are a pair of 3W speakers built in, which are surprisingly good. Of course, you won't get the deep bass and more clear frequencies you'd experience from a set of dedicated desktop speakers, but if you have limited desk space, these are certainly adequate and deliver a reasonably good level of output.

Their build quality is superb. The large base and screen itself are both solidly designed and pivot and tilt without



▲ The Philips Brilliance 288P6 is one of the better 4K monitors we've tested this year

any hint of plastic stress. The heavy base is ideal for a large screen monitor and helps keep everything stable, while still providing height adjustment and the other aforementioned ergonomic benefits.

The picture quality is similarly excellent. Philips

has done a magnificent job of crafting a panel that really shows off the ultra-high-definition quality of 4K resolutions. It's amazingly clear, sharp and crisp, with some of the best colours we've ever seen on a monitor. Videogames and UHD 4K video was an

absolute joy to behold. Normal, everyday duties were also a pleasure, with a superb clarity on the standard Windows desktop that was also gentle on the eyes for longer periods. Although, as with higher resolutions, we find it best to increase the size of the icons and zoom in when using Word.

There are a few picture presets available, the best being the Philips SmartImage feature, which will auto adjust the various levels according to what's being presented on the screen. You can, however, opt for a custom user setup, should the SmartImage setting prove to be inadequate for your tastes.

As you can tell, we were pretty impressed with the Philips Brilliance 288P6. It's an exceptional monitor, and one we'd be happy to continue using in future.

At around £350, the Philips 288P6 is quite well priced for the amount of features and the quality. It's only slightly more expensive than the Acer model, but it offers a far better level of display quality. Certainly one to keep an eye on for a 4K upgrade.



LG 31MU97-B

DETAILS

- Price: £750
- Manufacturer: LG
- Website: goo.gl/WZste0
- Requirements: CPU capable of 4K resolutions, DisplayPort cable not supplied



▲ The LG 31MU97-B is an exceptionally good 4K monitor



▲ At £750, it's a little too far out of most price ranges

66 4K content was presented perfectly, with each microscopic detail being sharp and clear 99

LG has done an exceptional job with its range of 4K TVs over the last year or so. Enter the likes of Currys, and you'll see a selection of superbly presented and technically wonderful models on offer. Has the company managed to mirror that success with its monitor range, though?

The LG 31MU97-B is one of only three 4K monitors in LG's arsenal of ultra-high-resolutions models, which seems a little strange considering what the company has so far accomplished in the UHD market. However, although series-limited, this LG monitor it is in fact immensely impressive. The 31" IPS screen has a maximum resolution of 4096 x 2160 pixels at 60Hz, a 50,000,000:1 dynamic contrast ratio, a response time of 5ms, 178° viewing angles and an advertised Adobe RGB colour spectrum of an impressive 99.5% along with a 10-bit colour depth, which supports over one billion colours.

Connectivity comes in the form of a pair of HDMI ports, a single DisplayPort and a mini-DisplayPort. It also has a three-port USB 3.0 hub and adequate ergonomic features with a -5° to 15° tilt, height adjustment to 140mm and pivot.

The design of the monitor is excellent, with a reasonably thin bezel surrounding the anti-glare coated screen. Movement through the tilt,

pivot and height adjustment was fluid and without the usual accompaniment of plastic under stress.

The screen quality was simply superb, probably the best out of the entire group. 4K content was presented perfectly, with

each microscopic detail being sharp and clear, and with deep and detailed colours as well as shadow detail and excellent brightness and contrast.

Despite that, there are a couple of problems with this monitor. The first is the

almost inexplicable lack of HDMI 2.0 support. You only get HDMI 1.4, which means you won't get full 4K at 60Hz through the HDMI port; you'll need to use the DisplayPort connection. It's a situation that is becoming quite common these days, especially on much higher resolution connections, but for a monitor of this standard (and price), it seems an odd omission. What's more, since it has two, you'd think at least one of the HDMI ports would be the latest supported version.

The second problem we have with this monitor is the cost. The LG 31MU97-B comes in at a rather shocking £750. While the quality of the product is excellent, spending £750 on a single monitor, even if it is 4K UHD, is a little extreme by our reckoning, even for those with very deep pockets.

If you can stomach the initial cost of the LG 31MU97-B, though, you're in for a real treat. At the moment, though, it's simply out of reach for the average consumer – and, to be honest, it's probably not worth the expense for business users.





Philips Brilliance 288P6

This was a difficult group to judge. Since the monitors on test were of a much better quality than the usual HD, and they're still priced a little too high for many users.

However, we believe the Philips Brilliance 288P6 offered the best quality in both design/build and screen output, and optimal value for money. While it's not as cheap as the Acer model, it's a better monitor overall.



BenQ BL2711U

Although it's slightly dearer than the Philips model, we think the BenQ BL2711U is an excellent 4K display. It has a number of great features, a great display and plenty to recommend it.

How We Tested

Each 4K monitor was hooked up to a GeForce GTX 970 4GB graphics card, via HDMI and/or DisplayPort. We tested a number of YouTube 4K videos, as well as some full HD movies. For games we ran *War Thunder*, *Elite: Dangerous* and *Fallout 4* in the highest resolutions possible.

	Acer CB280HK	AOC U2868PQU	BenQ BL2711U	Dell P2415Q	Philips Brilliance 288P6	LG 31MU97-B
Price	£290	£395	£450	£400	£350	£750
Screen Size	28"	28"	27"	23.8"	28"	31"
Response Time	1ms	1ms	4ms	8ms	1ms	5ms
HDMI Ports	1	1	2	1	1	2
DVI Ports	1	1	1	0	1	0
VGA Ports	0	1	0	0	1	0
DisplayPort	2 (1x mini)	1	1	2 (1x mini)	1	2
USB	0	4	4	4	4	3
Height Adjust	Yes	Yes	Yes	Yes	Yes	Yes
Tilt	Yes	Yes	Yes	Yes	Yes	Yes
Pivot	Yes	Yes	Yes	Yes	Yes	Yes
Weight	9.4kg	10.95kg	8kg	8.6kg	8.04kg	9.3kg

Top 5

Tech Fads

Because following following trends isn't always a good idea

1 Small Packages

Making technology take up less space makes a lot of sense most of the time. Computers that used to take up whole rooms had less power than devices that fit in our pockets today, and the benefits of that kind of progress are undeniable.

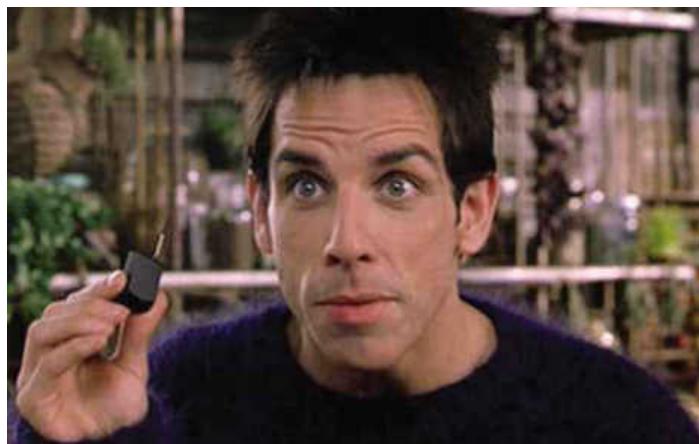
But it's also true that the shrinking of consumer electronics can be as much of a hindrance as a help. Whether it's tiny mobile phones or minuscule remote controls, there is one really rather obvious problem with making technology smaller: it's a lot easier to lose.

The good news is that right now, making things smaller isn't all that fashionable, and things tend to be shrunk only when it's actually beneficial. The bad news is that things are now getting much too big in some cases...

2 Bigger Is Better

For a while, it looked like smartphones were just going to keep on getting more diminutive, with this trend even being a source of comedy in the Ben Stiller movie *Zoolander*. But then the touchscreen smartphone revolution happened, and eventually everyone wanted bigger screens. No longer were phones for making calls; they were multimedia devices, ready for games, movies and browsing the web.

In fact, phones have got so big now that we've had to invent a whole new word to describe them: phablet. It might sound silly but, to be fair, it is easier than saying 'really massive, barely practical and not very mobile phone'.



▲ Will Zoolander 2 see Ben Stiller toting a 20K 45" iPhablet with 3D support?

3 The 'i' Of The Beholder

Thankfully, this fad is well past its peak, leaving Apple as the main culprit, but for a while, it looked like all technology names were going to begin with the 'i' prefix'. There's no doubt the iPhone and later the iPad were the main reasons for this, because they were hugely successful money spinners, but Apple has no exclusive rights to the 'i' prefix. In fact, it wasn't even the first company to launch a product called an iPhone: the InfoGear iPhone got there first.

But regardless of who came up with this naming convention, the iFad was very real and very, very annoying.

4 A New Dimension

Over the last few years, a lot of people have come to the same conclusion about 3D cinema and TV: it's a bit rubbish. Oddly enough, this is probably the conclusion people came to in the 1950s, when 3D stereoscopic 3D media was also being hailed as the next big thing.

The technology used to create the illusion of depth has changed in many ways, of course, with simple blue and red glasses being swapped for things like active shutter specs. But for the most part, the concept is the same: each eye sees a slightly different image to the other, which is supposed to trick our brains into seeing flat images as three-dimensional.

Unfortunately, it's just not that good, it gives some people headaches, and it doesn't make a bad film any better.

5 More Pixels!!!

We're not going to say we don't appreciate HD, because big TVs and monitors with sharp images are impressive, and they can improve your enjoyment of films, television shows and sports. We'll even admit that 4K isn't a complete waste of time.

But it's also the case that many of us are being sold display technology that's unnecessarily high resolution. Unless you're sitting mere inches away from your TV, are you really going to notice the difference between 4K and 1080p if you? We certainly struggle to differentiate 720p and 1080p when sitting at a natural distance.

Where things get even more ridiculous is with 4K smartphones, because the pixel density of a display at this size makes it practically impossible to tell the difference between a 1080 and a 4K screen. **mm**

Top 10 Tips For Groove Music

Stream music from OneDrive, play music and artwork on your TV, and more with the Groove Music app in Windows 10. Here are **Roland Waddilove's** best tips

1 Store Music In OneDrive

The Music folder on your PC's disk drive is the obvious place to store music files like MP3s and other audio types, but there are advantages to using OneDrive. One of the most important of these is that OneDrive is synced across all the PCs you use, so you have access to your music library from any computer.

Open Explorer and go to the OneDrive folder. If there isn't a Music folder, create one, and then move any music files in the C:\Users\YourName\Music to the OneDrive Music folder. The amount of music that can be stored in OneDrive depends on your account. Right-click the OneDrive folder at the right side of the taskbar in the pop-up tray and select Settings. On the Account tab is the space used and the maximum available. It can be anywhere from 5GB to 1TB. If you have only 5GB, then you might want to put just your favourite albums and tracks in OneDrive.

There aren't any facilities in Groove Music to copy your CDs to your PC's disk, but there are other tools that can do the job. iTunes can be used, for example, which will save music tracks as AAC, MP3 or WAV, all of which Groove Music can play. You could use iTunes to rip your CDs, copy the tracks to the OneDrive Music folder and then enjoy streaming music all for free.

After adding music, open the Groove Music app and wait while it scans for music files and adds the album artwork. It can take up to half an hour for all the artwork to appear, so be patient.

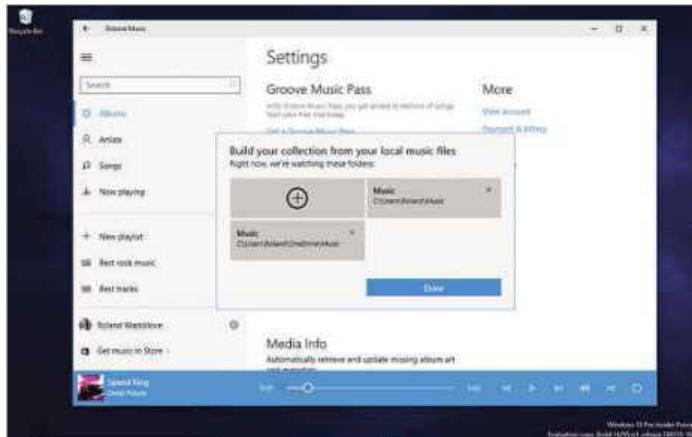
2 Set Music Locations

If you have a large music collection and a small disk drive in your PC, you might have your music stored on an external USB drive. A network drive can also be used for sharing music files across computers and devices instead of using OneDrive. Configure Groove Music to look in these alternative locations for audio files.

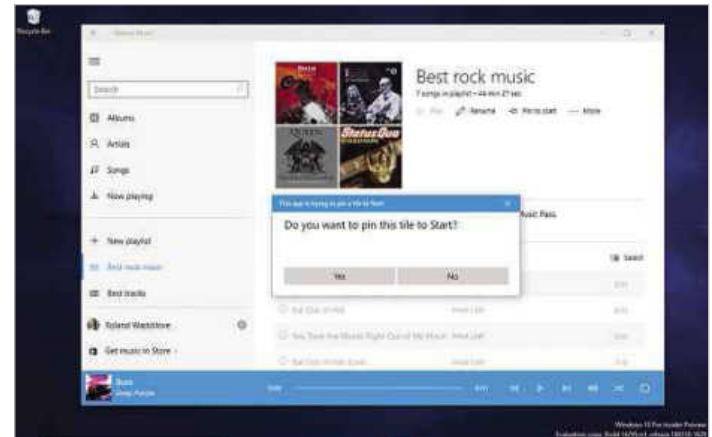
Open Groove Music and click the gear icon at the bottom of the left panel. Under Music on this PC, click 'Choose where we look for music'. Your personal Music folder and OneDrive Music are already listed. Click the plus button to add another location and use the Select Folder window to choose the drive and folder.

3 Show Live Tile

The Start menu live tile is useful because it shows the artist and the track or album being played, along with artwork. The tile looks great. Right-click the Groove Music tile on



▲ Add the folders and drives where Groove can find music files



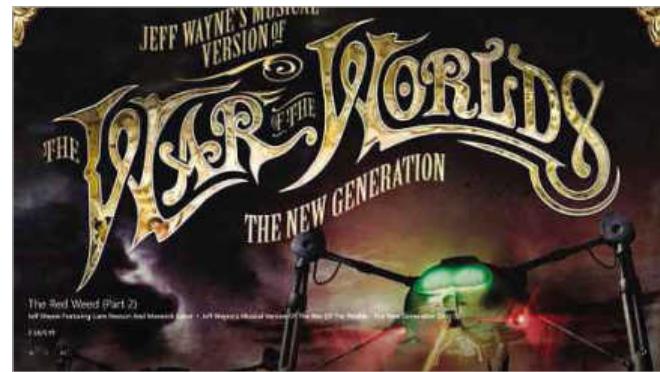
▲ Add songs, albums and playlists to the Start menu as tiles



▲ Play music on your PC on your phone or tablet anywhere



▲ Dark and light themes are available. Choose them in Settings



▲ Play music and show album artwork on your TV using Chromecast

the Start menu and select Resize > Large. Then right-click it and select More > Turn live tile on.

4 Pin To Start

To make it quicker and easier to access your favourite music, you can pin tracks, albums and playlists to the Start menu. Right-click any track or album and select 'Pin to Start' from the menu that is displayed. Select a playlist in the left panel, and under the title on the right is 'Pin to Start'. Click it. Clicking a tile on Start opens Groove Music and begins playing.

5 Stream Music

One of the best features of Groove Music is that you can stream your music to any phone or tablet, no matter where you are. Your computer does not need to be switched on, and it makes use of OneDrive.

After adding tracks and albums to the OneDrive Music folder, go to the app store on your phone or tablet and search for Groove Music. Install the app, open it and sign in using your Microsoft account (OneDrive, Outlook, Xbox username/password). Groove Music shows all the music on OneDrive (give it a few minutes to get all the artwork), and you can select and play it.

Watch out for data charges, though. It's best to stream music on wi-fi, where your data allowance is unlimited. Tap the menu button, select Settings to find two options to turn off mobile data for downloading and streaming if you're worried you might forget.

6 Import iTunes Playlists

If you have iTunes on the computer and have created playlists, they can be imported and played in Groove Music. Click the gear icon on the left to open Settings and then click 'Import iTunes playlists'. The music be available either on your PC or through Groove Music Pass, because it doesn't import the music, only the playlist.

7 Choose The Theme

Two graphical themes are provided for the Groove Music app, and you can choose between light and dark. Click the gear icon, and in the settings, scroll down to the bottom and select 'Dark' or 'Light' under Background.

8 Buy Music

You can't buy music from within Groove, because it's purchased in the Windows Store instead. Open the Store app and select the Music section at the top. Browse the music and click the price button to buy albums and tracks. If you use

more than one computer or if you use the Groove Music app on your phone or tablet, go into Settings and enable the option to download music purchased on other devices. You can then buy music anywhere and listen to it anywhere.

9 Avoid Duplicates

If you have music in OneDrive and you sign up for Music Pass, the all-you-can-eat streaming music service, you will have duplicates, because a track on OneDrive is also in Music Pass. To remove the duplicates, go to Settings in Groove Music, and in the OneDrive section turn on the switch, 'When I add a song to OneDrive, remove any version that came from Groove Music Pass'.

10 Play Groove Music On TV

If you have a big screen television and a great sound system for it, you can output Groove Music and artwork to it and it makes a great audio visual show. It's brilliant!

You need Chrome for this. Open it and click the hamburger icon to show the menu. If you have a Cast menu item then you're okay, but if you don't, go to Help > About Google Chrome to get the latest version or go to chrome.google.com/webstore, then search for and install Google Cast.

1. Click Cast on the Chrome menu and a Cast to menu appears top centre in the browser window.
2. Click the down arrow, and the menu changes to 'Select Source'. Choose Cast desktop.
3. Select the Chromecast device in the menu.
4. A message box appears: "Chrome Media Router Screen Sharing Request". Under 'Do you want Chrome Media Router to share your screen and audio output', click Yes.

5 Start Groove Music, select a track, album or playlist and play it.

The audio volume on the TV is independent of the volume control on the computer, so you can turn down or turn off the computer's speakers and sit back and listen on the TV, using the TV remote to turn up the volume.

Your PC's desktop and audio is sent to the TV, so the final thing to do is to select 'Now Playing' on the left in Groove, then click the double-headed arrow on the album artwork to make it full screen. It then fills the TV screen too. A Ken Burns style effect adds a bit of movement, and text at the bottom of the screen shows the album and track that's playing. It's perfect for a relaxing evening. **mm**



Keyboards 101

Mark Pickavance talks about the layout of keyboards and how their origins have dictated common aspects across the globe

Although never trained to do so, technically I can touch type, mostly through a disturbing level of repetition. I'm so familiar with the QWERTY layout I only get really confused if I'm presented to letters organised alphabetically, as they are occasionally in some applications and devices.

But how did we end up with the seemingly random nature of QWERTY, are their better alternatives, and how do other language speakers cope with their variants?

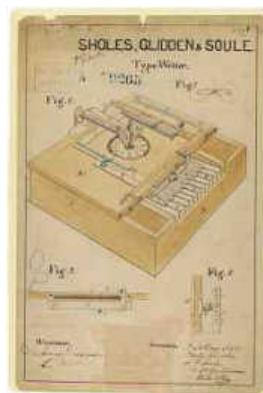
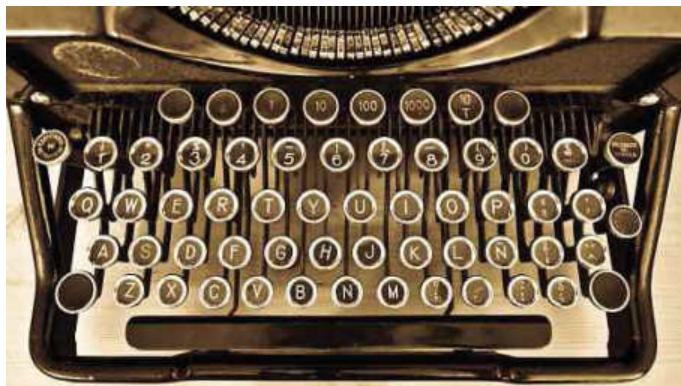
I have some answers, but not all of them, I suspect.

Origins

As most people are aware, the QWERTY layout of the modern era has its origins in the typewriter. Specifically, the Sholes and Glidden machine is generally accepted to be the first commercially successful typewriter when it became widely available in 1874.

The concept of an ad hoc printing machine was first devised in 1866 by inventor/printer Christopher Latham Sholes, engineer Carlos S Glidden and their then associate Samuel W Soule.

Eventually, Soule left the endeavour before the typewriter was finished, and his place was filled by James Densmore, a man who



◀ The original patent for the typewriter imagined something more like a musical keyboard than one for bashing out letters.

saw the business possibilities of this invention and was prepared to provide financial backing to propel the project forward.

James Densmore is critical to this story, because according to common legend, it was he who was the grandfather of QWERTY. Early prototypes suffered with a problem: as the speed of typing increased, the likelihood of adjacent keys being struck in quick succession causing them to collide and jam.

It was he who came up with the idea of grouping commonly used letters with less common ones to lessen the possibility of a jam, and through a nefarious limitation of the hardware that coalesced into QWERTY.

What we also know both Glidden and Sholes tweaked the layout as the device progressed into the very limited production runs that the inventors initially attempted.

These early machines were diabolically unreliable, and as

“James Densmore is critical to this story, because according to common legend it was he who was the grandfather of QWERTY”

they often shipped great distances across the US to their owners, getting parts and repairs proved something of a logistical nightmare.

There was also a cultural problem regarding typed letters to overcome. Early recipients often became incensed by them, as they assumed that they'd had a typed letter because either their eyesight or education wasn't good enough to read the handwriting of another, which they took as an insult.

With remarkably low market penetration, low reliability and a high unit cost, this is where the typewriter and QWERTY might have ended if it wasn't for Americans' unrelenting love for firearms.

In 1873, Sholes and Glidden approached the gun maker E Remington and Sons, which was looking to diversify, and demonstrated their machine at Remington's New York offices.

At the end of that meeting, Remington agreed to make 1,000 machines, for which they got \$10,000 (approximately \$200,000 today) and royalty rights, but the originators got to serve as the exclusive sales agents.

What was critical about this agreement was that being experts in mass-producing complicated machines with a high level of reliability, Remington effectively re-engineered the Sholes and Glidden typewriter to make it both reliable, better at taking abuse and cheaper to manufacture.

These early machines still had some problems, not least the cost of \$125 in an era where many skilled people earned less than \$40 a month. Yet they managed to sell 400 of them, including one to the famous author Mark Twain (aka Samuel Clemens).

The breakthrough came in 1976 when the machine, along with some rubbish concocted by Alexander Graham Bell's called the 'telephone', was exhibited at the Centennial Exhibition. That increased sales by tenfold of the Remington No.1 model, and the company considered it worth further design time. Two years later, the No.2 model appeared.

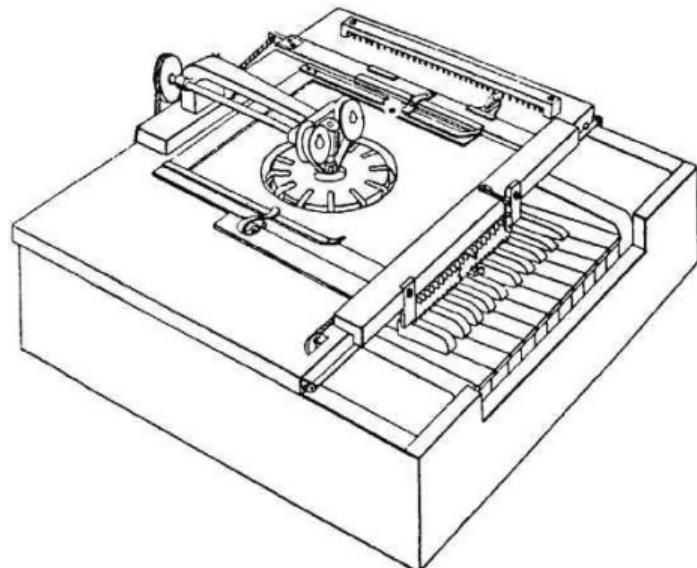
This was a typewriter that we'd recognise today, in that it generated both upper and lower case letters, a critical feature missing from the original design.

The number of these machines in circulation rapidly increased, volume production reduced the cost to £80, and competing machines also started to appear.

All of them used the QWERTY layout, and they began to appear outside the USA in Europe and across the globe.

They were embraced initially by writers, journalists, lawyers and businesses, where clarity of communication was paramount.

Little did Sholes, Glidden and all the other contributors to the typewriter know that their concept would live on past their device





▲ Microsoft's fascination with ergonomics has led it to make some curious keyboards. I reviewed this one, and it was terrible!

into a totally different one that would change the world almost a century after their invention.

The Dvorak Diversion

Once typewriters got into wider circulation, lots of people commented on the inefficiency of the layout, among them US academic Dr August Dvorak.

In 1936, he took a long-term research project about keyboard layout and distilled it into a patented design, the Dvorak Simplified keyboard (DSK).

What's interesting about his approach is that all the vowels are in a single line on the left side of the 'home row' (where the hands naturally rest), while the most used consonants are grouped on the right.

The problem was that even in the 1930s, there were lots of people with QWERTY experience, so Dvorak needed to convince people that conversion was possible and beneficial.

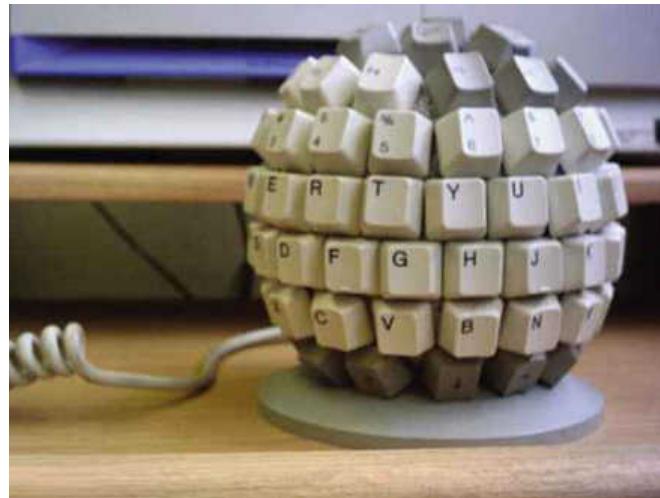
In conjunction with the US Navy in 1944, he devised a sturdy in which 14 typists were converted to the new layout, and they averaged 52 hours to detrain from QWERTY and retrain on Dvorak. According to his findings, they became 74% quicker on Dvorak and significantly more accurate.

That's because on the new layout, the fingers travel less, since there are fewer combinations of keys where the fingers have to travel large distances across the keyboard. As the distance of travel increases, so does the likelihood of hitting the wrong key, in theory.

The US Navy were convinced, and ordered 2,000 typewriters with the Dvorak layout on the basis of it.

However, that might have been premature, because later research revealed that Dvorak's enthusiasm for his own layout might have got the better of his empirical approach.

In the early 1950s, many organisations inspired by the experience of the US Navy started to seriously consider transition



▲ AZERTY, the nightmare that French computers users live with. Reviled from the point it was created, over 100 years ago

to Dvorak, and the US General Services Administration, an independent agency of the United States government, commissioned a study to determine if the claims were true.

Regrettably, under strict controls the majority of the speed increases and the ease of transition seemed largely illusory.

Research done since has determined that it is possible to get typists to switch to almost any layout in a similar time frame, and having the majority of used keys on the home line is probably only worth a speed increase of 4% at best.

What really undermined Dvorak's research was that it later became known that the navy study on which the whole technology was promoted was actually the third study he'd performed. And because the results didn't support his hypothesis, he'd junked the collected data.

Supports of DSK will claim that Earl Strong, the man dispatched to conduct the tests disliked Dvorak, both the man and his keyboard, even before the first test was conducted, so these tests are likely tainted too.

Modern ergonomics researchers now consider that Dvorak's ideas were good, but he didn't really consider how complicated a physical action typing is and that the speed anyone can achieve is limited by many factors, not just the specific layout.

You can still get Dvorak keyboards today, and Windows even includes support for the layout. There are people who swear by them, and others who say that they can switch easily from QWERTY to Dvorak without breaking sweat, but the real problem that this layout has is that most people aren't familiar with it.

And this precise issue, the devil-you-know syndrome, has also been a factor in maintaining other keyboard layouts that even more unsuitable than QWERTY.

C'est La Vie

While QWERTY has its detractors in the English speaking world, give a thought to those on the other side of the channel, who



Touche standard	Touche de fonction	Touche Entrée
Touche Windows	Touche directionnelles	Autres
Touche menu contextuel	Touche de fonctions supplémentaires	



have suffered not typically in silence for a whole century with a layout that is totally reviled.

What's mildly fascinating about AZERTY, a derivative of QWERTY, is that no one will actually take responsibility for devising it. At some point in the last decade of the 19th century, it appeared on typewriters sold in France and Belgium, and it continues to this day for most French speakers.

Yet even in the first decade or use, many declared it not fit for purpose. It was hated so much that in 1907, after much ergonomics research, Albert Navarre presented the ZHJAY layout as an alternative. But already some had learned to cope with AZERTY, and ZHJAY gained little traction, unfortunately.

66 What's mildly fascinating about AZERTY, a derivative of QWERTY, is that no one will actually take responsibility for devising it 99

Even to the casual, non-French speaking observer, AZERTY is something of a disaster. Oft-used characters are difficult to generate, while things that are almost never used get an un-shifted key to their self.

It's also bizarrely biased to the left hand, and the centreline contains a collection of easily assessable letters that few French words use.

The most striking of these is the ù (u-grave), which gets the key that on QWERTY is the right of the 'L' on the centreline. Sadly, in modern French, ù is only used in one word, où, meaning 'where'.

You would therefore have my sympathy if you get that letter while playing Scrabble in France. But you won't, because the



'diacritical' marks as they're known are ignored in that game, I'm led to believe.

What's really odd is that where ù gets a whole key to itself, other accented characters require all sorts of finger acrobatics, even though they're used in many common words.

Especially challenging are capitalised versions of accented letters, some of which are so difficult to generate, people can't be bothered to use them any longer.

That's a real problem according to the ministry Academie Francaise, which is the guardian of all things cultural in France, including the language and how it is represented. According to guidelines it's issued, capital letters deserve the correct diacritical including acute, circumflex, accent circonflexe, diaeresis, grave and cedilla, or they're technically not pronounced correctly.

When you also factor in the ligature letters æ and œ, neither of which you can get out of a AZERTY, it's no surprise there is now a very serious debate about dumping AZERTY before it damages French any more than it is already considered to have done.

Much research has been done in an attempt to make a new layout that addresses the concerns of both the cultural bastions, regular users and global French speakers.

From these, a number of likely candidates have surfaced, including one very well considered design called BEPO (or BÉPO). The problem that this and other layouts face is the same one that sent ZHJAY packing a hundred years ago: once people have learned to cope with a layout, they're never keen to relearn that skill. It would take a monumental effort to switch now, and few believe that the government in France has the appetite for rubbing its populous the wrong way by demanding AZERTY is dumped.

Compared with some countries, though, France has had it easy.

Outside The Latin Box

With the spread of the typewriter, a range of variations for the majority of European languages were developed. The common feature that most of them exhibit is that they use a 'Latin script' (i.e. they use letter forms that are based on Latin representations



▲ No geek should be without this input device. Yes, it's a keyboard for typing in Klingon. Qapla'!



▲ Donald Trump's keyboard. No, really



▲ Yes, a Cherokee keyboard. Better than smoke signals or other guff they put in old westerns, I'd suggest

of letters). These are used in many languages, even if many of them can't actually agree on the sound they represent. It's been calculated that about 70% of the world uses a writing system built around these symbols, and its application is wholly phonetic and is the basis of the International Phonetic Alphabet.

The keyboards that use Latin script are broken down into those that are based on QWERTY (like AZERTY, and those that use the letter forms but in alternative organisations, like Dvorak and Neo.

But beyond these are keyboard layouts for languages that either have their own letter forms or that aren't even phonetically represented. There are a wide range of these, including the Brahmic scripts (Bengali, Thai, Tibetan, etc.), Arabic, Armenian, Cyrillic (Russian, Bulgarian, Serbian, Ukrainian), Georgian, Hebrew, Inuktitut, Cherokee and Tifinagh.

If you're wondering, as frankly I did before I wrote this, how hard it is to get a keyboard in Cherokee, then you'd be surprised to know that this is a supported layout and script for Windows, iPhone and Android.

Considering there are less than 25,000 native speakers of Cherokee in the US, that's quite impressive. However, some

rare languages have no written form and therefore no available keyboard representation.

But what really made this Westerner's mind boggle was when I started to look at how Asian language keyboards work, given that their representation is often not phonetic but pictographic, or an odd combination of the two.

Special Input Methods

In English, we limit ourselves to 26 commonly used characters, and a handful of other symbols like hyphens and exclamation marks. Imagine if you can use a language where there are at least 2,500 commonly used symbols, all of which you need to get out of a keyboard that has no more keys than a QWERTY one!

That's the sort of challenge faced by Chinese and Japanese computer users, as their characters aren't created through a direct key=symbol translation.

Essentially, all input starts with sending the keyboard into a particular mode often by entering a pronunciation cue and then a number if there are variants.

On a computer versus a typewriter, heuristics are used to zero in on the correct symbol in a method that's much like the guessing game that auto-complete plays on your phone.

Since the advent of graphical interfaces, typing in Japanese usually involves a small input that then generates an on-screen menu with the most likely characters you'll need and then the selection of the desired symbol.

In the Japanese JIS standard, often the word is inputted phonetically or kana, then converted to Kanji by the input method that you've predefined. However, there are other input methods that are really complicated, and they use special key layouts, including the infamous Oyayubi Shifuto (thumb shift) layout where the space bar is split into two or four special modifying keys.

Of the Asian languages, Chinese is the most complicated to key, because there are multiple ways to generate a character using either pronunciation or structure. In the structural mode, shapes can be inputted that are combined to define the symbol, mimicking the way that they're constructed when they're actually drawn.

As that comment suggests, many Chinese users have invested in drawing accessories for their computers, because sketching



▲ A 'Maltron' keyboard, which came from a collaboration of Lillian Malt, who ran a secretarial training business, and Stephen Hobday, an electronics engineer. They launched the Maltron in 1970s. It was aimed at avoiding repetitive strain injury. While not a huge success, its thinking was influential



▲ Another Maltron keyboard that you can still buy today. This one is designed specifically for single handed operation.



a symbol is much faster than generating it from the keyboard, unless you're an expert at using one.

The third major Asian language, Korean, is entirely separate from both Japanese and Chinese, in that their keyboard is phonetic, and the symbols are in the Korean alphabet Hangul.

Where this differs from Western languages is in how it is written, where consonants and vowels are grouped together into syllabic grids. This process is automated by the computer as the words are presented, as there is generally only one way to correctly group the combinations.

‘The formality of written English isn’t something you’d generally hear in conversation, unless it was between Sherlock Holmes and Doctor Watson, perhaps’

There are two keyboard layouts that the Koreans generally use, Dubeolsik and Sebeolsik. The Dubeolsik layout is the most common, and looks rather like a QWERTY keyboard with extra shifted symbols on it. Korean speakers would recognise that the symbols are organised so that the consonants are all on the left and the vowels on the right.

That the Korean keyboard sits at an intersection of European and Asian thinking is often presented as a contributing factor in that region's success in the tech industry.

What makes Asian languages additionally complicated for Westerners to follow is that Japanese, for example, can be written as English, as in left-to-right, top to bottom. But it can also be written in Talegaki mode, where the characters start top right, go down and then the next column moves from the right to the left.

These variations and the frankly horrific input schemes provide some explanation as to why few Westerners ever master these languages to speak, and even fewer to type.

The Future Of Keyboards

The first computer I used didn't have a keyboard; it used punch cards. But since that point, I've been welded to this input device

for approaching 40 years. Better layouts, more ergonomic key placement and the best mechanical switches can't ignore the fact that this peripheral is seen as a hindrance in communicating with a computer.

To that end, we've spent many years developing increasingly sophisticated alternatives, like voice and handwriting recognition. Yet, years after these things have become effective enough to use, we're still going back to the keyboard. Why?

As a long-time keyboard user, I'm inclined to believe that there's something about the keyboard that mirrors part of the way that the human brain works. And a by-product of this modelling is that once you've mastered a layout to a certain level, you can disassociate your conscious mind from the physical actions, allowing you to concentrate on the contents of what you're typing rather than the action. In the same way, we don't generally spell out the words we're speaking or the phonetics in our head before we say something.

This is much more difficult for people to do when writing, as we don't tend to talk in the compact style that we often type. The formality of written English isn't something you'd generally hear in conversation, unless it was between Sherlock Holmes and Doctor Watson, perhaps.

I do know some journalists that use voice recognition, and they've adapted to the idea of creating fully formed sentences that they can then speak. I tend to write in a series of waves, often where I revise a sentence part way through or even change the focus entirely as I construct it. This doesn't lend itself well to speaking, though it works well enough with a keyboard.

I'm not saying for a moment that I couldn't convert to keyboard-less output, but given the amount I produce in the time I've got, it would be an expensive experiment and therefore one that I'd rather not be involved in performing.

And that is the rub, really. The QWERTY keyboard, for all its infamous points of failure, is the curse we almost all know, and because of that, it's very difficult to change.

This is not a unique scenario, because years after very efficient automatic transmissions have been available, people are still buying cars with more pedals than feet to operate them and the opportunity to select the least efficient gear while driving.

Keyboards have been around for over 140 years, and they look unlikely to be seen off by either Cortana or Siri in the near future. However, to languages like Japanese and Chinese, their advantages may be much greater, and therefore the take-up in those regions might well be higher.

That we're using QWERTY now, a layout designed to solve an engineering flaw in the construction of a device no longer in general use, is proof that the law of unintended consequences is alive and well within all complex systems. **mm**

Alphabet Pi: J

David Briddock meanders through Raspberry Pi technology from A to Z

THIS WEEK: Jessie, Jam Events and Java

Jessie

The official Raspberry Pi operating system is based on the work done by the Raspbian open-source project, which is itself based on Debian Linux. From time to time, the Raspberry Pi Foundation takes a snapshot of the Raspbian community's work to create a new official Raspbian distribution image (raspberrypi.org/downloads).

In October 2015, a new image appeared based on Debian Jessie. This major OS release has many changes, including visual improvements, new and updated apps, additional development tools and many subtle operational modifications.

Jam attendees are immersed in the excitement of electronic circuit building. Here they can discover how to interact with various electronic components like LEDs, buzzers, sensors, motors and so on, using hand-crafted Python code. And they can witness that wonderful sense of achievement and pride that lights up a maker's face, whatever their age, when a new project springs to life.

The huge popularity of the Pi means the number of Jam events just keeps growing and growing. The Raspberry Jam website (raspberryjam.org.uk) lists many Jam locations including London,

66 **Jam attendees are immersed in the excitement of electronic circuit building** 99

Highlights include boot-to-desktop (instead of the command line); desktop updates to menus, check boxes and radio buttons; new, multi-tab configuration dialogues; an updated Epiphany web browser; and many app updates to help stability, fix bugs and improve performance.

And Jessie certainly doesn't lack functionality, with over 35,000 pre-compiled software bundles, known as packages.

Jam Events

Jam events are fun and friendly gatherings aimed at showcasing the Raspberry Pi's potential. They're the perfect place for Pi enthusiasts to show off their building and hacking talents, and you're bound to leave with a treasure trove of new ideas, construction advice and helpful tips.

Manchester, Cambridge, Bristol, Coventry, Milton Keynes, Durham, Machynlleth and even Tokyo.

Jams are often hosted by universities and colleges, keen to engage the next generation of budding engineers and software programmers. Some, like the University of Manchester Computer Science (pi.cs.man.ac.uk), are also running 'Bake Off' competitions – often with high-tech gadgets as prizes.

The Cambridge Jam, or CamJam (camjam.me), is one of the most popular and forward thinking Raspberry Pi Jam setups in the country. The fact it takes place in the Raspberry Pi Foundation's home town certainly helps, but it also attracts an impressive line-up of high-profile speakers, like *Adventures in Raspberry Pi* book author Carrie Anne Philbin (goo.gl/fcRL4X). And sometimes



even Pi Foundation founder Eben Upton (goo.gl/WavWah) makes an appearance.

Java

Java is a popular language used in a wide range of open-source and commercial software projects, such as Android apps. A partnership with Oracle means Java is included in the Raspbian image.

Raspbian Jessie has two new Java applications in the main menu's Programming category. Called BlueJ (bluej.org) and Greenfoot (greenfoot.org), they're both aimed at simplifying the app building experience. Both offer a graphical coding environment, which mixes mouse-driven design and code generation with traditional hand-coded statements.

A joint venture by the University of Kent and Oracle, Greenfoot is specifically aimed at introducing a younger coding audience to the concepts of constructional thinking and design, while BlueJ is more applicable to those who already have a little coding experience. **mm**

Remembering... Box art

REMEMBERING...

David Hayward spent a lot of time looking at boxes

Computer and video game box art, or cover art, was once just as important element of game marketing as the game itself. Who cared if the game consisted of a stickman running a wire-thin strip of landscape, dodging ASCII characters? If the box art displayed something totally amazing, then the game invariably sold.

'Never judging a book by its cover', is what we're often told, and never was that sage advice more relevant in another media than when we used to buy computer games as a physical tape, floppy or disc that came packaged in a box. Many were the hours we spent ages looking at the shelves of John Menzies gripping a fiver, before picking up the game with a cover depicting a great space war (or some barbarian chap with scantily clad damsel in tow brandishing a sword and fighting off some terrible looking beast), bought it, got home and loaded it up to be met with something beyond awful.

That's box art for you. Tweaking and playing with the imagination; fiddling with your eyes and making you believe that, possibly, within the many ones and zeros that make up the game within, there's something truly wonderful.

On the other side of the coin, however, there were really bland and nondescript box art attempts that held an exceptional game within. Look at *Strider* for the Mega Drive; a cracking game with really naff box art. There

were some, though, that hit the nail on the head, combining both amazing packaging with a really decent game inside the box.

Take, for example, *3D StarStrike* for the Spectrum. A great game by Ian Oliver, Andrew Onions and Graeme Baird, with excellent art work by none other than Oliver Frey. Then there's the Amiga game *Awesome*: a seasickness-inducing space faring game by Psygnosis, with box art by science fiction artist John Harris.

History

Obviously video game box art only really appeared once video games started to arrive in the home. One of the earliest examples is *Shooting Gallery* for the Odyssey, from 1972.

Throughout the 70s the box art became more and more elaborate, with publishers quickly realising that the gamer of the day wanted their imaginations fed through the cover and into the game (despite the game being a selection of coloured blocks). *Star Ship*, *Escape*, *Invasion Orion*, *Datestones of Ryn*, *Adventureland* and the *Temple of Apshai* all brought some fine box art throughout these early gaming years.

The 80s were a golden age. The Spectrum, C64, Amiga and ST all had some incredible examples of box art, far too many to mention here. Even the nineties had some memorable moments: remember *Gods*, *Monkey Island*, *Steel Empire* and *Epic?* Bet you do...



▲ The 70s, when box art ruled supreme



▲ There are some examples, though, that are really quite dire



▲ Some art, though, perfectly matched the game

Did You Know?

- Stephen Bliss is the Senior Artist at Rockstar Games, and the one behind the GTA box art
- One of the earliest box artists was Jerrol Richardson, who worked with Intellivision throughout the 70s and early 80s. Sadly, he died in 1991
- *3D StarStrike* wasn't the only game that Oliver Frey did the artwork for. There's also *Vulcan*, *Beachhead 2*, *Hawkeye*, *Creatures*, *Creature 2* (all of Thalamus games, basically), *Napoleon At War*...
- Ciruelo Cabral is another renowned fantasy artist who worked with the DOS games of the *Ishar* series, among others

Box art is still going, and there has been some interesting additions in recent times. Modern examples, though, do tend to pale in comparison to some of the great hand drawn artwork of the past.

The Good

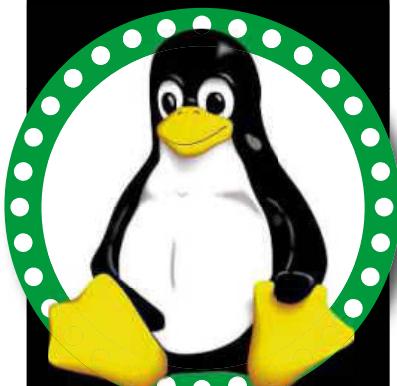
Amazing art work could lead into the game, fire your imagination and have you gazing at it even when you weren't playing the actual game.

The Bad

Poor box art forced your eyes to keep wandering over the shelves, in search of other titles. Often, bad box art hid some exceptional games, and you were always reminded never to judge a game by the quality of its cover.

Conclusion

In this digitally downloadable age, box art has taken a bit of backseat in the overall marketing of a game. While there are still notable examples of it about, we tend not to notice them. Not surprising as we're browsing Steam's library, rather than the shelves of the local computer shop.



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Linux Recycle

Recycling old kit with Linux

I got into an interesting conversation with someone the other day regarding recycling old hardware. According to the chap I spoke to, the company he works for has a process in place whereby any old computer hardware is recycled throughout the local community. The great thing about this is that the company has local schoolchildren and volunteers in to help with the disposal by installing Linux on all the PCs that leave the building.

The company has made friends with a couple of the local high schools, and students studying IT GCSE can come in for a couple of hours and install the latest version of Ubuntu. Also, if there are hard drives that need replacing, the students run a routine whereby the data is scrubbed several times before having a pre-installed version of Ubuntu set on the drive.

This way, the company gets to have its data wiped from its PCs for free, while the students and volunteers from the local Linux group get to learn how to install an operating system and something of the hardware as they take PCs apart and install components.

The Utopia Of Recycling

While this model may not work for a lot of companies, it's certainly one that seems to be worth consideration. I've personally worked for a company that took its security to the extreme, and with every PC that was replaced, the old one was taken away and certified destroyed. That in particular was an immense waste of resources, as we (those of us who worked in

the IT section) said we were willing to remove the hard drives and donate the machines to the local schools, charities and so on. Even an electrical safety check would have been cheaper than having the entire thing destroyed.

Obviously digital security of a company's data must come first, and having any old set of volunteers in to wipe old hard drives isn't always recommended. But it makes you wonder. If there was

upgrade cycles was more than enough for a modern Linux installation.

Less Waste, More Linux

It got me thinking, though. Are there any other companies that are contributing to a recycling scheme such as this? Do you have any thoughts on the matter, with regards to a country-wide recycling scheme, using Linux as the OS of choice?

66 Perhaps I'm being too optimistic about society as a whole 99

a larger-scale government recycling system for old hardware, companies could easily get behind it.

Looking back at the company I worked for, there were some good PCs being destroyed: 3GHz, i3, i5s with 4/8GB of memory. Even the extremely old kit that somehow managed to hang on past previous

Perhaps I'm being too optimistic about society as a whole. Then again, what's wrong with a little hope?

Until next week, folks.

▼ *Can more be done to recycle old kit, with Linux installed?*



Casing The Place

Sven Harvey takes a look at a new crowdfunding campaign

A new Dutch venture to create another Amiga 1200 case replacement has started a campaign on Indiegogo. The brainchild of Jarno Smit, the Amiga Case, as it's called, is an officially licensed product, with the seal of approval from Amiga, Inc. It promises to not only offer a replacement case for the Amiga 1200 computer, but also a casing that can be used for thin mini-ITX motherboards and the Raspberry Pi 1B+, 2 or 3.

Featuring high-quality non-yellowing plastic, the case will not be an identical replacement for the A1200 case, but will include more space for expansions and the like, while looking very similar to the original Commodore moulding.

Two distinct versions will be released. One is a direct replacement for an A1200 motherboard and keyboard, but it allows further expansion, as well as adding a drive bay and better cooling vents for CPU expansion cards. The second features a recessed area to rest an external keyboard rather than the holes through which the original A1200 keyboard can be used, but it still supports the use of the original A1200 motherboard, thin mini-ITX board or Raspberry Pi, thanks to the anchoring points inside.

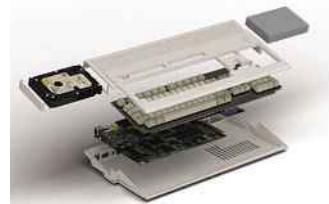
Both versions will feature, on the back, plates that can be swapped out to support the different motherboard types (with a promise to open up the design to allow further back plates to be custom made/3D printed). They also have the capability to support expansions such

as the Keyrah V2 keyboard adaptor and alternative drive options such as the Kryoflux or GoTek floppy emulator, as well as internal use of a 3.5" hard disk.

With the case being able to support any version of the A1200 motherboard and thus automatically the up-and-coming Amiga Reloaded Amiga AGA replacement motherboard from Individual Computers, there appears to be a distinct interest. Also, the cost is lower than a previous campaign to produce

replacement A1200 cases, with a standard black or white casing to support the A1200 motherboard and internal keyboard running at €69 plus postage and packaging.

You can find out more at the campaign page: goo.gl/jy3TXe.



Enhancer Software

Named after the marketing term used by Commodore to introduce the Kickstart ROM, and Workbench and Extras disks for AmigaOS (now referred to as AmigaOS) 1.2 and 1.3, A-Eon Technologies Enhancer Software is essentially the AmigaOS 4.1 extras disk... but either on optical disc or as a download. Two editions exist, offering subtly different editions of the included software. Take a look at the PDF at goo.gl/co5y37 or check out the Amiga Wiki entry at goo.gl/LVvAH4 for more information

The key inclusions are Warp 3D Nova (a driver and graphics layer package), CANDI (a desktop compositing engine for Workbench), AmiDVD and TuneNet (a music media player).

Apologies - Amiga Works Documentary

In the last Amiga Mart, unfortunately I made an error, and this is the correct version:

Paul Bridger, who worked on the website for Amiga Works, has been filming and compiling video from others to create a documentary film. The documentary film will be covering the career of Allister Brimble up to and including the release of *The Amiga Works* album. The composer has created music for many Amiga games (while working with Team 17 and other developers and publishers), as well as titles on a plethora of machines from the C64 and Spectrum (*Dizzy*) to the PC, and many consoles including the XB1 version of *Goat Simulator*.

More information should be appearing about the film on the album's site at www.amigaworks.com,

where you can still buy the music, but you can find out more immediately at the documentary's Facebook page at www.facebook.com/amigaworks.



Sven Harvey has been our Amiga specialist for over 16 years, drawing on his 25 years retailing computer and video games and even longer writing about them

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Ian McGurren is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

G Whiz

Ian McGurren takes apart LG's flagship, without voiding the warranty...

LG has traditionally been something of an afterthought for many mobile buyers, due in some part to its previous budget products often coming with a compromise in quality and also because it doesn't quite have the push of Apple or Samsung. But it's been there from the beginning of smartphones and has even been responsible for some of the best Android handsets ever produced (the G2 / Nexus 5 arguably being its pinnacle). For some time its flagship handsets have followed in the wake of Samsung's Galaxy S, albeit ever closer, and frequently it's offered a premium experience for a lower outlay than the competition. But it hasn't quite toppled the king yet. Will the G5 change that?

With flagship handsets more powerful than many people's tablets, we're in this place now where getting noticed means having some sort of 'gimmick', for want of a better phrase. With the Galaxy S7, it's the gorgeous chassis and the curved OLED screen; with the iPhone, it's iOS (arguably); with the HTC 10, it's the Ultrapixel camera; and with the Lumia 950, it comes in the form of the Continuum desktop. So what does LG's fifth-generation flagship offer? Er, a removable battery? Kind of.

The LG G5 is a good device, as flagship handsets go. Once again, aluminium is the material

of choice for the body, but it's not quite the same feel as other alu handsets, because a 'microdising' process applied to the surface means it's not cold to the touch. The glass has the now expected slight curve to the edges, but unlike previous LG G handsets, the volume controls have returned to the side of the unit to help slim the unit down. The back isn't completely empty, though: there's the fingerprint sensor and, unusually, two cameras – one standard 16MP and another wide angle at 8MP.

Hardware-wise, as expected, it keeps up with the Joneses with a Snapdragon 820, 4GB RAM, 4K video and a QHD screen. Interestingly, here it has an always-on element to the screen, which given the screen is LCD, not OLED, is unusual, though it apparently only consumes 0.8% of the battery per hour. It also has a 8MP front camera, micro-SD

and USB C with Quickcharge compatibility. No water protection here, though.

So far, so flagship. But what of that gimmick? Well, the G5 is actually modular, with a removable bottom section that can be switched out for different hardware – with a removable battery to boot. At launch, there are two additional modular components.

First is a high-quality digital audio converter module from Bang and Olufsen and a Cam Plus module from LG. The former adds the ability to play high-resolution audio up to 32-bit (24-bit through standard headphones), including streaming, presumably to 32-bit compatible streamers, probably from B&O.

The Cam Plus module offers a battery boost, hardware controls and a better grip, although there's no new optical hardware – more a device that makes better use of what's already available. But given the camera(s) are very good, it's certainly worth considering in lieu of a compact camera.

The G5 isn't groundbreaking, the hardware is decent, if not stunning, and the modular concept is interesting, but so far these are the only modules announced, and it appears the onus is now to be on third parties to create more. However, given the G series often come in cheaper and go down in price quite quickly too, the G5 would make an attractive premium proposition at the right price.



Windows 10 Retried

A broken computer helps Andrew Unsworth make peace with Windows 10

I had planned to spend the long bank holiday weekend doing whatever I fancied and generally allowing my id free reign for a bit. Even when on holiday, I generally have to do what I'm told, so a bit of freedom really wouldn't have gone amiss.

Sadly, however, one of my wife's computers had stopped working, and she needed a replacement for Tuesday morning, which meant I had to either hastily assemble a new one from various bits left lying around or donate an older PC to her. As it was, I decided to donate an older PC, as I would have to buy a couple of extra components to knock up a 'new' system.

This wouldn't have been much of a problem were it not for the fact that I'd forgotten I'd previously installed Windows 10 on the older PC many months ago and forgotten to turn it back to Windows 7 within 30 days of the upgrade. Not that I've got anything against Windows 10. The reason I'd wanted to wind things back to Windows 7 is because, at the time, the driver and software support wasn't 100% to my satisfaction – an example being the fact my anti-virus software didn't work with Windows 10. I'd upgraded two computers, and wound one back (the one I use most often) but forgot to do the other one.

A few months on, and things seemed to have been ironed out. I couldn't find Windows 10 versions of some drivers, but on the whole it worked well with my software and utilities,

so I decided to give the PC in question a clean installation of Windows 10. I had wanted to pop an SSD in there too, but my emergency SSD was already doing time in my wife's office and wouldn't be free until the very Tuesday when the recycled PC was due to be installed.

In the old days, when four cores referred to the members of an Irish pop band and 2GB was nothing but an expensive extravagance, you needed an optical disc from which to install Windows, but in this modern age we have the luxury of installing from a USB drive. Whether that USB drive is a regular flash drive or an SSD connected to an adaptor is up to you. Microsoft makes it easy to create a bootable device too, thanks to its Media Creation Tool, which can be downloaded from the Microsoft website (tinyurl.com/q8oqvug). Be warned, though, it'll take a while to download Windows 10 if you don't have a fast internet connection. Sadly, I don't, so it was many hours before I could even start installing it.



You must specify the USB drive to which Windows 10 will be installed before Windows 10 starts to download, and you can choose to download a 32-bit or 64-bit version. This is handy for creating a Windows installation drive on one computer for use on another. Alternatively, you can choose to create a DVD. Once Windows 10 has downloaded and has been written to the flash drive, you can boot into it and commit Microsoft's latest OS to disk in the manner to which we have become accustomed in recent years.

If you haven't tried Windows 10, then now might be a good time to check it out. I'm still suspicious of it and haven't upgraded my other PCs yet, and I'd recommend trying it out on an older, less important PC, as well as checking that Windows 10 drivers are available for the various components in your PC. However, Windows 10 has improved since I last looked at it. If you've been tempted to upgrade, then now could be a good time to do it.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner and his handshaking skills are second to none

Entrepreneur



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming



Back In Black

The creators of Doom and Quake are back with a new shooter project, Blackroom, which will be returning to Kickstarter with a gameplay demo in the near future

This week, Ryan takes a look at the new shooter project from the creators of Doom, and checks out the construction update in PlanetSide 2...

Plug & Play

Since its inception in 2009, Kickstarter's become a haven for veteran game developers hoping to recapture their past glories. David Braben successfully launched space sim *Elite: Dangerous* via the site; Japan's Keiji Inafune caused a ripple of excitement with his *Mega Man* spiritual successor *Mighty No. 9* in 2012 – a game which, to date, still hasn't appeared.

Late last month, *Doom* creators John Romero and Adrian Carmack were the latest big-name designers to take to crowdfunding with their latest venture. Unsurprisingly, perhaps, their project is a first-person shooter in the mould of their pioneering 90s efforts – called *Blackroom*, it's billed as a return to the strafing and jumping tactics of *Doom* and *Quake*. The designers' pitch gave a flavour of the game's sci-fi back-story – something to do with a virtual reality machine gone haywire – and showcased their studio Nightwork Games' location in Ireland.

Yet one thing was conspicuously absent from Romero and Carmack's campaign – anything tangible from the game itself. With only a few pieces of concept art

to go on, some web dwellers commented that they'd expected to at least see some early gameplay footage.

As a result, Nightwork took the unusual step of cancelling the project on the 29th of April; the aim being, according to an update from the studio, to come back with a working demo in a few months.

"There's a hitch here," Nightwork wrote on Kickstarter, "a hitch that's making us do something that's right for the game, the team, and the community: we're pressing 'pause' on the fundraising campaign for *Blackroom* to complete this gameplay demo. Simply put, this will take more time than the Kickstarter has left, so we've decided to suspend the campaign and launch a new one when the gameplay demo is ready. We believe, however, it is the right choice. We know you do, too. Thanks to your feedback, we know we should have included it at launch."

The reaction to *Blackroom* is a sign of how cautious potential backers have become when it comes to crowdfunding. Where a big name like David Braben or John Romero would have been enough to ensure a clamour

of pledges three or four years ago, would-be supporters are now far more keen to see some work-in-progress before lending their support.

Blackroom certainly has a solid concept behind it on paper: Nightwork has described a game with abstract and surreal level designs, where the environment shifts in unpredictable ways. If the studio can show that concept working well in practice, then the project should get the support its creators were expecting in the first place.

You can find out more about *Blackroom* at kck.st/1SusKK7.

Online

PlanetSide 2 may not have the marketing budget of, say, *Destiny* or *Titanfall*, but it's still one of the most entertaining sci-fi shooters going – there's something decidedly exhilarating about its huge online battles, which can see hundreds of players clashing on a single map. Indeed, Daybreak's MMOFPS even holds a Guinness World Record for the biggest first-person shooter battle.

While *PlanetSide 2* has the shooting side of things nicely balanced, Daybreak's now added a touch of strategy.



▲ Daybreak's free-to-play shooter has a new construction system, which lets players build RTS-style bases and fortifications

At the end of April, the studio launched an all-new construction system, which allows players to build their own bases, vehicles, tools and other objects. The key to construction is a new mineral called Cortium, which can be mined and then used to create all kinds of bunkers, garages, shields, anti-infantry turrets and so on. Of course, harvesting Cortium takes a bit of work; Daybreak explains that you'll have to summon an Advanced Nanite Transport vehicle (or ANT for short), which has an on-board laser specifically designed for digging up the precious mineral.

"ANTs are four-man transports that have mining lasers for harvesting Cortium nodes, which are scattered around the map," Daybreak explains. "The ANT can be deployed at any time, which will reveal access to a building terminal from which you can equip and then place fortifications (at a cost to Cortium)."

This means that, armed with an ANT, you can drive just about anywhere on the map and quickly deploy useful things like fortified walls or bunkers. Placing these constructions is as simple as a click of the mouse, though bear in mind that they're quite vulnerable in the

minute-or-so it takes for them to be built – in other words, it's probably best not to start building bases in the middle of a screaming gun battle.

With *PlanetSide 2* being a free-to-play game, you can also exchange in-game currency for Cortium, though we'd be far too tight to resort to that. As you've probably gathered, the construction update adds an entire strategic layer to the game, where squads can create entire fortified enclaves full of Cortium silos and elaborate defences.

PlanetSide 2 may be approaching its fourth anniversary already, but it's pleasing to see that Daybreak is still packing the game with more to see and do. You can read more about *PlanetSide 2*'s construction system at www.planetside2.com.

Incoming

John Romero and Adrian Carmack's retro FPS may be on hold, but then there's always id Software's *Doom* reboot to scratch our 90s shooter

itch. While reaction to the multiplayer beta may have been mixed, there's still the single-player mode to look forward to, which is something id's been showing off in the days leading up to *Doom*'s release. An hour-long preview (youtu.be/txmv2qFRuXl) gives us a look at its campaign's opening moments – and the demon-bothering action looks as febrile and violent as you'd expect. *Doom* begins in a seemingly deserted base, full of airlocks, corridors and hangars, which soon become infested with shambling, fireball-lobbing denizens of hell. These rank-and-file monsters seem satisfying to despatch with id's new glory kill system, where close-quarters attacks leaves enemies exploding in a shower of gore and prizes. Id has said there's the semblance of a story behind all the shooting but, let's be honest, we're not expecting *The Great Gatsby*. This is a game that lets us despatch demons with chainsaws, after all. *Doom* is out on the 13th May.



▲ After years in development, id Software's *Doom* reboot is finally here. Expect big guns, chainsaws, a legion demons and gallons of blood

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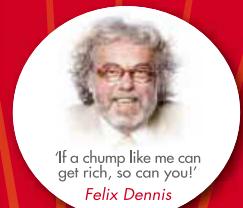
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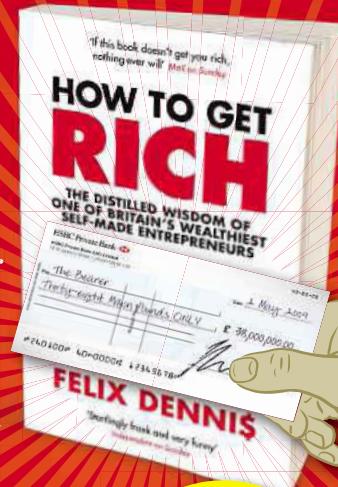
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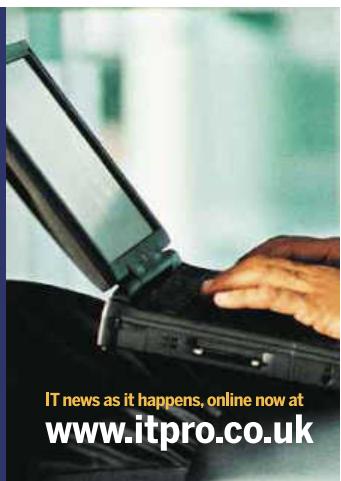
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WANTED: You bought a Corsair water cooler, with a square block. You fitted it to your Intel processor. You want to make a few pounds from the spare A.M.D. bits? Contact me!
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Email: johnbeirley@gmail.com

WANTED: PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.
Tel: Bill (07742) 061569 or (02641) 769503.

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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Fiddly Fonts

I need to create some wedding invitations. As as the one in the family who uses a PC, I've been tasked with this. Ho hum.

I'm not too bad at using office software to create documents, and I've managed to cobble together a decent invitation. However, In order to finish it off and get the look I want I need to use a specific font. I've found this font online and have downloaded it, but it's a .zip file and I realised when I got the download, I've no idea how to actually use it and how to get it to appear in my font list.

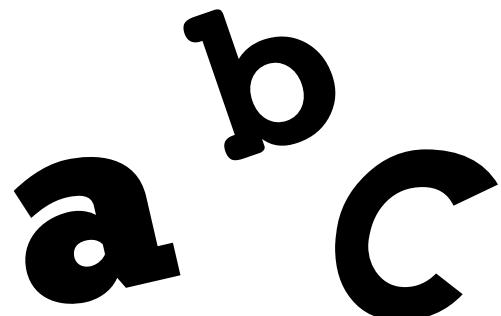
I use OpenOffice Writer as my word processor and I've looked around its options and menus, but can't find any way to use the font. I've also seen the fonts directory in Windows, but it won't let me copy the .zip file into the folder and there are no other zips in there as far as I can see. I'm just lost.

I have a feeling this is a very simple topic and that's I'm simply ignorant of a basic technique for getting this done, but I hope you will take the time to answer my query.

Casey

As I always say, Casey, things are only easy if you have the answers and no one knows everything. We're here to help, regardless of the problem.

Installing fonts is actually very easy, but it's also something people tend to over think. There is a fonts directory in Windows, where you can see your fonts and previews and you can even hide ones you don't wish to use. However, the folder doesn't behave like a

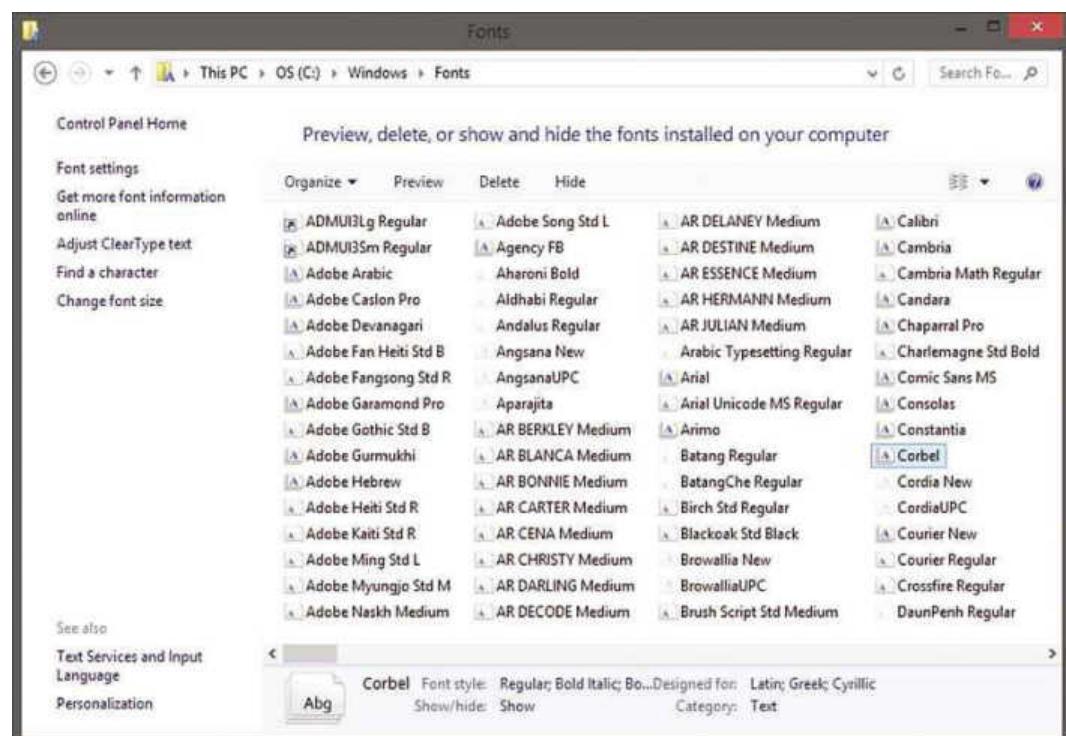


**66 Things are only
easy if you have the
answers 99**

normal one and you can't simply paste fonts into it, at least not any more with more recent versions of Windows.

Instead, all you need to do is extract the font file (which will turn out to be a .fon, or .ttf) to your desktop (or another location where you can find it easily). Then, you need to right-click the extracted file and select Install. That's it; you're finished!

The font will be installed and you'll be able to see them listed in not only OpenOffice, but any other program that uses fonts. You may need to restart your software to see the new fonts, though.



Third Party Security

I have used computers for many years and I've never suffered a virus. I currently simply use Windows Defender and rely on Windows Firewall to protect me and I have never had any problems. I am therefore confused and puzzled as to why I would want to use the firewall protection software as indicated on page 43 of the latest issue (1410) i.e. ZoneAlarm and AVG antivirus software.

I would appreciate if you could give an answer as to why I should use the software that your magazine recommends and if it should be used instead of or as well as the Windows products I have mentioned.

Alan

You're lucky to have avoided any security problems in your time using PCs, Alan. I suspect this is down to a mixture of your current security solutions and careful, vigilant use. Clearly, Windows' own security tools are working well for you, and so there's no real reason for you to worry about switching.

However, many would agree that the built-in tools supplied by Microsoft aren't

as powerful as dedicated third party applications that are purposefully designed to cater for specialised tasks. A dedicated antivirus application will almost always possess more power and greater scope than a bolted on addition to a larger piece of software. There's also something to be said for specialisation.

Microsoft may know its onions when it comes to making operating systems or office suites, but it doesn't specialise in security tools to the same degree as McAfee, Symantec and other vendors of tools like AVG and ZoneAlarm. It's one of the main reasons Microsoft is always on the lookout for companies to buy, as this allows the Redmond giant to expand and add to its software diversity and offer more capable applications that complement its main product line.

For now, Microsoft simply doesn't specialise in consumer security software in the same degree as other third parties and so most will find additional apps like AVG and ZoneAlarm to be superior and more effective to the Windows options. They're usually more powerful, boast more features and better at protecting your system. They usually perform better in lab tests and benchmarks too. As they're not tied into the OS, they're

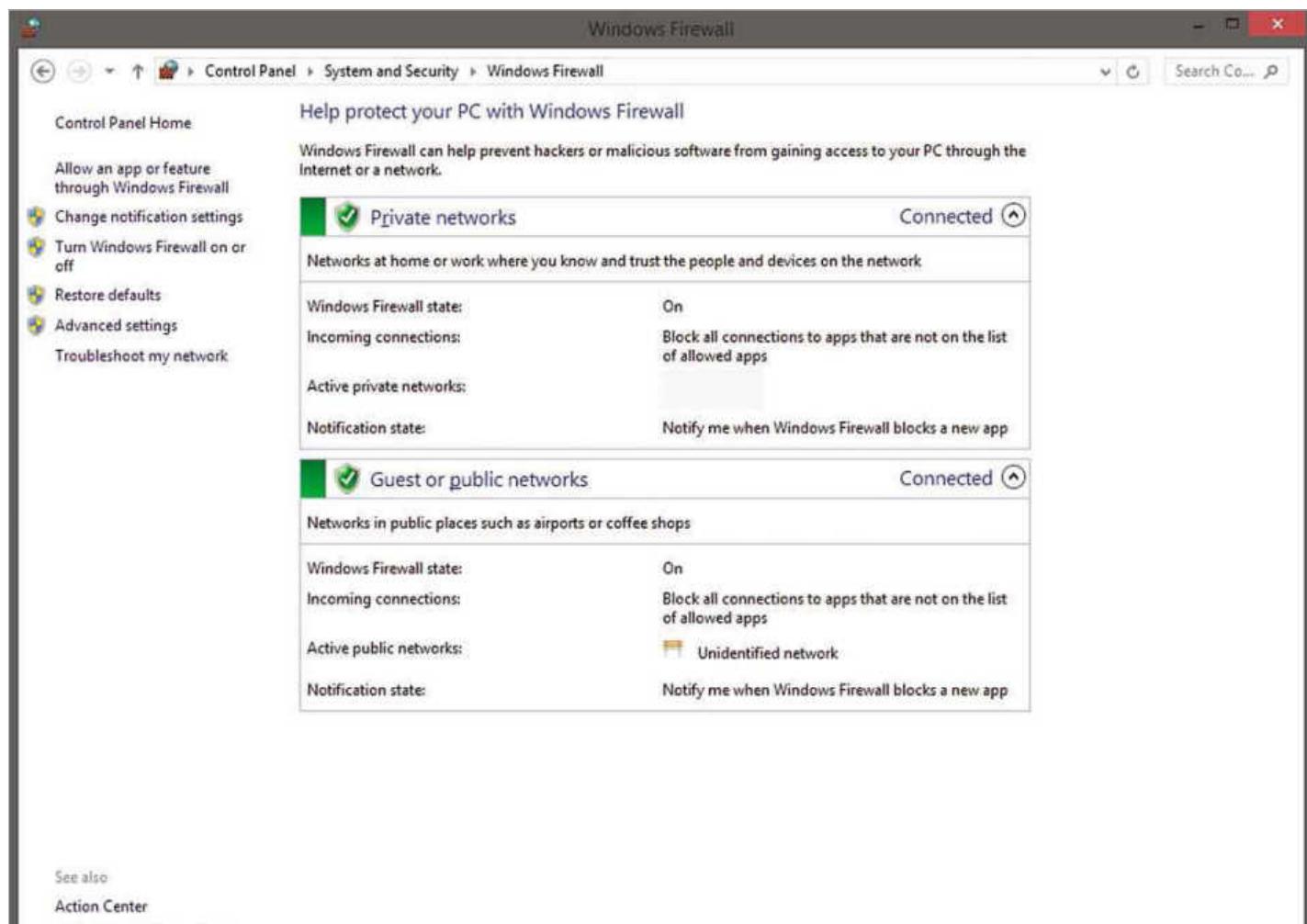
also not limited by Microsoft's design or standardisations and so can tailor their use for users who may not like Microsoft's approach.

That said, there's also something to be said for user preference and if you prefer the Windows' own route and it works for you, that's fine and there's no need to worry. Some people are perfectly fine with Internet Explorer, for example, whilst others dislike it and use third party browsers like Chrome or Firefox. It's often simply subjective.

If you do decide to try third party options, you can't really use more than one at once as security software is notorious for not getting on well in tandem. As security software is very invasive in terms of interfacing with your PC and software and more than one similar tool can cause all sorts of problems, so only use one antivirus app and one firewall.

Adware scanners are not problematic in that way – it's actually better to use more than one – but the core antivirus and firewall need to be exclusive. Windows will automatically deactivate its own tools if it sees a third party app.

▼ Windows' built-in firewall is decent enough, but many prefer more powerful solutions



Control Panel Home

Allow an app or feature through Windows Firewall

Change notification settings

Turn Windows Firewall on or off

Restore defaults

Advanced settings

Troubleshoot my network

Help protect your PC with Windows Firewall

Windows Firewall can help prevent hackers or malicious software from gaining access to your PC through the Internet or a network.

Private networks Connected

Networks at home or work where you know and trust the people and devices on the network

Windows Firewall state: On

Incoming connections: Block all connections to apps that are not on the list of allowed apps

Active private networks: Unidentified network

Notification state: Notify me when Windows Firewall blocks a new app

Guest or public networks Connected

Networks in public places such as airports or coffee shops

Windows Firewall state: On

Incoming connections: Block all connections to apps that are not on the list of allowed apps

Active public networks: Unidentified network

Notification state: Notify me when Windows Firewall blocks a new app

See also

Action Center

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Jason

Your Starter For 10

My netbook came with Windows 7 Starter. This has a RAM limit of 2GB, which I've maxed out. If I take the free upgrade to Windows 10, will this limit remain, or could I upgrade to 4GB or even more?

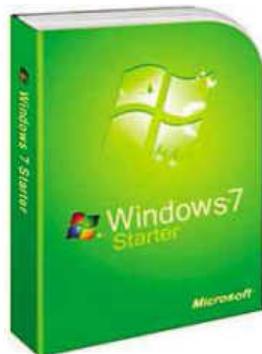
**M. McKinley,
Gloucestershire**

There are only two consumer editions of Windows 10: Home and Pro. Users of Windows 7 Starter, Windows 7 Home Basic, Windows 7 Home Premium, Windows 8 ('Core'), Windows 8.1 ('Core'), and Windows 8.1 with Bing ('Core') are upgraded to Windows 10 Home. Users of Windows 7 Professional,

Windows 7 Ultimate, Windows 8 Pro, and Windows 8.1 Pro are upgraded to Windows 10 Pro. In your case, then, my friend, you'll get Windows 10 Home. Your 2GB RAM limit will be gone.

Now, Windows 10 Home has a RAM limit of 128GB. But crucially this is only on the 64-bit version. General hardware and software restrictions mean that all 32-bit versions of Windows are limited to 4GB. As Windows 7 Starter is only available as a 32-bit version, your upgrade will also be 32-bit – you can't switch architectures. So you'll be able to fit 4GB – about 3.5GB will be available – but no more.*

** Or can you? If you were to upgrade as normal, activate, download the 64-bit version,*



▲ Does Windows 7 Starter's 2GB RAM limit (plus any other restrictions) stay in place after the free upgrade to Windows 10?

wipe your hard drive, then use the 64-bit version to reinstall, would you get away with it? I fancy you would. Have any readers tried this?

Buy Cheap, Buy Twice?

My Galaxy S4 has served me well for three years but now it lasts for only a couple of hours or so on a full charge and shuts down without warning when the charge drops to exactly 18%. This happens with both the original battery and the replacement I've just bought from Amazon (I believe this is genuine, though it only cost about £6). Should I conclude that the problem is with the actual phone?

Robin, Virgin Media

I'm confident the phone is fine, Rob. Sudden shut-down well before 0% is a common symptom of a bad or failing battery. Yes, it's odd that the phone dies at exactly 18% with both batteries, but I wouldn't read too much into it.

There's no chance that a new £6 battery will be genuine. As shown on Samsung's website (goo.gl/3GuUU0), the real price for an S4 battery is £25. Still, it's quite possible to buy something decent for £6 – less, even. eBay

is probably easier than Amazon, as you can get a good look at a seller's feedback. If there are lots of negatives for the chosen item, or for similar items, go elsewhere. Any seller with feedback below about 99.5% should be treated with caution. And remember: if you're not happy with an item once it arrives, open a dispute. Buyers almost always win, and if you push a little you'll receive a pre-paid returns label.

My own approach when buying batteries – not just for

phones but also for laptops and so on – is to settle for ones that don't even pretend to be genuine. I figure manufacturers of batteries carrying false branding have something to hide, relying on the brand to achieve sales. Manufacturers of batteries carrying unheard-of Chinese brands are probably confident that the products can sell on their own merits.

▼ Which one's real and which one's fake?



A Bit Suspect

A few years ago I built a PC on the cheap. The CPU was a lowly Sempron 140 (2.7GHz, single-core), which I've recently upgraded to a Phenom II X4 945 (3.0GHz, quad-core). I acquired this for the princely sum of £10. Now I want to upgrade the RAM. This is currently a kit of $2 \times 512\text{MB}$ (DDR3), and I'm awaiting delivery of a kit of $2 \times 2\text{GB}$. Interestingly, this was advertised as not being suitable for Intel systems – apparently it's AMD-only. The eBay seller assures me it'll be fine on my ASRock 760GM-GS3, but surely DDR3 is DDR3? What's he on about?

Ryan, Gmail

It's true, Ryan. Such RAM will only work on AMD systems. In fact, I believe it'll only work on Socket AM3 and AM3+ systems (so you're in the clear). There's a lot of it for sale on eBay. Some sellers are giving out long lists of incompatible chipsets, but it's a PC's CPU that needs to be compatible, not the chipset, because on a modern PC the memory controller is in the CPU.

To get a handle on the issue, we need to understand about ranks. These days, a system's memory bus is 64-bit (per channel), and the individual chips on a RAM module are usually 8-bit. Clearly, eight chips are required to form that 64-bit bus, and that's a rank – a group of chips with a total bit-depth equal to the width of the memory bus.

Let's say we've got a 2GB RAM module described as being 1Rx8 . That means there's one rank and the chips are 8-bit. Therefore, each chip must have a capacity of 256MB

(often written in bits, not bytes, so here that would be 2Gbit – just multiply by eight). Eight 8-bit chips are needed to make the 64-bit rank, and $8 \times 256\text{MB} = 2\text{GB}$.

Now let's say we've got a 2GB module described as being 2Rx8 – two ranks of 8-bit chips. There must be sixteen chips here, giving $2 \times 64\text{-bit}$, so it follows that each chip must have a capacity of 128MB (1Gbit). There would typically be eight chips per side, but it's not true that all dual-sided modules are also dual-ranked. Our 1Rx8 module, for example, could be made with four chips per side, making it dual-sided but not dual-ranked. Similarly, our 2Rx8 module might have all sixteen chips on just one side – single-sided but dual-ranked (not a common occurrence).

Sadly, it's often impossible to determine a module's internal layout without banging the product code or serial number into Google and poring over the datasheet. Modern memory controllers can usually handle both 8-bit chips and 16-bit chips, so you could hold in your hand a module with four chips per side and assume it's single-rank – $8 \times 8\text{-bit}$ or 1Rx8 . But it could well be dual-rank – $2 \times 4 \times 16\text{-bit}$ or 2Rx16 .

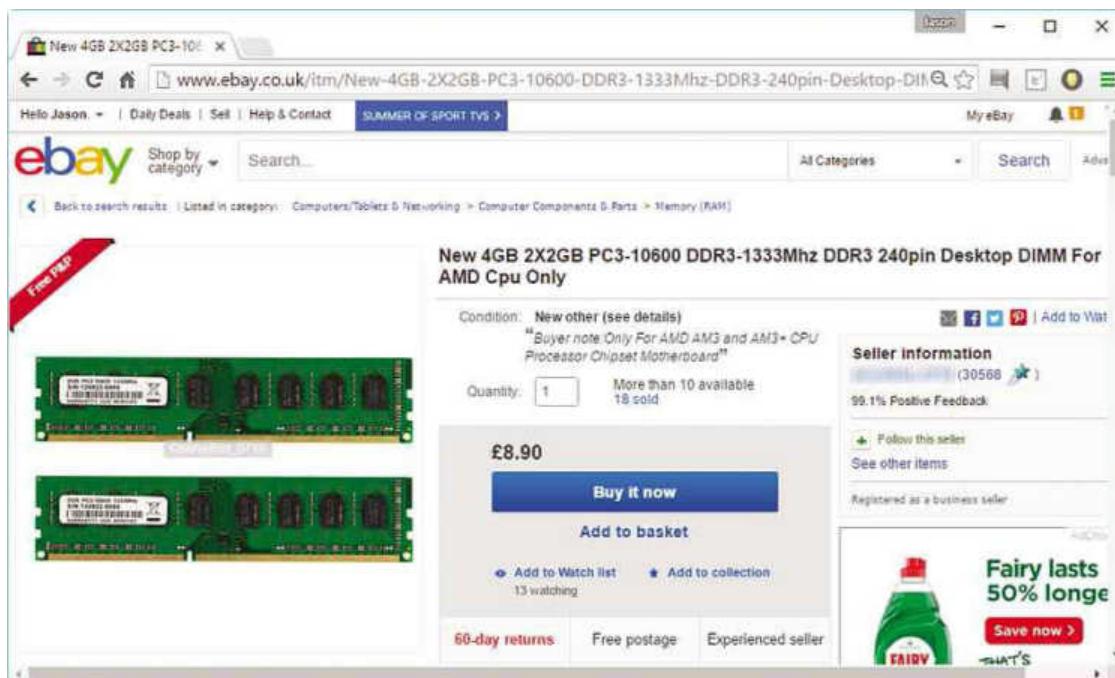
And so we come to these AMD-only modules, Ryan. At last! Bizarrely, the chips on these are 4-bit. Sixteen are needed to create a rank – 1Rx4 . They might be all on one side or split over both sides. You'll never see an AMD-only module with just eight chips. Indeed, on larger-capacity modules, you might see thirty-two chips – 2Rx4 . The problem is that 4-bit chips are non-standard, at least on the desktop. Only the FX, Phenom II, Athlon II, and Sempron CPUs

for Socket AM3 and AM3+ know what to do with them.

Why use 4-bit chips, then? The clue is in the fact that AMD-only RAM modules sport branding you've never heard of, fake labels of branding everyone's heard of, or no branding at all. And they're cheap. In short, the chips they use are actually 8-bit, but they're so bad that half the address lines have had to be disabled. They're cast-offs. They should be in a skip.

With some modules, the chips may actually be genuine 4-bit affairs, intended for servers, where 4-bit chips are fairly common (I confess I don't know why). Here, they've probably failed quality tests. I wouldn't be surprised if some modules produce errors in Memtest86+ right out of the box. Others may appear okay until stressed or run for long periods. The upshot, Ryan, is that you should send your $2 \times 2\text{GB}$ kit back as soon as it arrives. Even if it works. Spend a few quid more and buy a 'proper' kit from Kingston, Crucial, Corsair, or another reputable manufacturer.

Note – In systems that support ECC – RAM with error-correcting code – the memory bus is 72-bit. So is a rank, therefore. The extra bits are used for detecting and correcting errors, not for holding data. A 2GB ECC module described as being 1Rx8 would have the same $8 \times 256\text{MB}$ layout as a 2GB non-ECC module but there would be a ninth chip, one not adding to the capacity. ECC memory is chiefly used in servers and generally isn't compatible with desktops (there are exceptions, notably on AMD systems).



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◀ AMD-only RAM? What's that all about?

Crowdfunding Corner

If you own an iPhone, you'll know that Apple's official accessories can be overpriced and excessively minimalist. Luckily, the crowdfunding community can often provide where Apple falls short...

iStand Apple Pie

The iStand is a beautifully designed multi-functional power station designed to provide the ideal docking station for iPhones and Apple Watches, though it also supports iPads, MacBooks, Kindles and all sorts of other USB-enabled hardware.

One specific selling point is that it includes a magnetic charger for the Apple Watch, which isn't common in this sort of device. It also has two USB charging and syncing ports for the iPhone and Apple Watch, plus an additional port for charging other USB devices. All you need is a USB-C input to charge and access all three connected devices.

The device has already begun to manufacture, so there shouldn't be a long wait after you commit to backing this particular project – in fact, it's estimated that it will ship in July 2016. The campaign is looking for just AUD \$5000 (£2,600) so there's a very good chance of it hitting its goal in the allotted campaign time of one month.

You can get your hands on an iStand Apple Pie for just AUD\$75 (approximately £39). Higher tiers give you discounts on multiple purchases, so if you know someone else who might want one you could both save on the overall cost!

URL: kck.st/1QSLiS1

Funding Ends: Wednesday, June 1st 2016



Fat Battery

The iPhone's battery issues are well-documented, but most of the solutions are imperfect and impermanent. A portable power bank, a charge case with a secondary battery inside – it doesn't really fix the problem for good. The Fat Battery could, though.

This isn't an accessory – it's an all-out integrated kit that actually replaces your default iPhone battery with a new one that's four times as powerful. The trade-off is that your phone becomes a lot thicker, maybe that's worth it for the increased power. The entire kit can be installed at home, or at any iPhone upgrade shop (voiding your warranty is, unfortunately, not optional, however).

Kickstarter backers can get the battery and upgrade kit for \$129 (£90) with a choice of the iPhone replacement spacer in Space Gray, Silver, Gold or Rose Gold to match your phone design (or not, we guess). You also get a free fat battery sticker, in case that's something you like the sound of. The kits ship in August 2016 providing the campaign reaches its \$100,000 (£70,000) by the end of the month. It's a quarter of the way there with more than half the time to go, so it's not yet guaranteed – but things look good!

URL: kck.st/1q1FFv5

Funding Ends: Friday, May 27th 2016



Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

A Coffee Collection

Our dedication to the greatest drink ever

There's no secret that we thrive on coffee here at Micro Mart. That and sweets, chocolate, cake, games, cake, chocolate, sometimes pies and cake. But coffee is king.

Regardless of whether it's a mocha-chock-a-lotta-latte or some other unpronounceable tongue-twister or simply the kind of rich, blackest of black coffee that you could stand your spoon up in, you can guarantee that we'll be seen sipping away at it.

Therefore (and maybe because we've had so much of the stuff this morning), we thought we'd put together a selection of coffee-related apps for you to check out while sipping at your favourite brew.

Coffee Maker

Coffee Maker is a game for kids, in which they can pretend to make mum and dad a coffee in the morning without being horribly scalded by the finicky and very old latte machine lying in wait in the kitchen.

With it, you can make a virtual coffee using a blend of beans and different ingredients, and finish it off with a flourish of hazelnut syrup or something similarly sickly.

Coffee Wallpaper

There are loads of coffee-related wallpapers available on Android, but the ones created by HAnna are by far the better, we think.

With some cleverly shot images of the beans, in the process of being ground or roasted, against the backdrop of a pure white cup and with a wisp of steam rising from an earthenware mug, you can almost smell those delectable aromas.

Coffee Recipes

Coffee Recipes offers you a vast array of step-by-step instructions and lists of ingredients needed to make coffees from around the world.

Included are egg nog coffee, frosty mocha coffee, mint chocolate coffee, spiced french coffee, classic Irish coffee and alpine carnival coffee.

Indeed, after following a few recipes, we're now well and truly away with the fairies and tapping out ten thousand words a minute – none of which make any sense.

Coffeemania

As with the coffee recipes, Coffeemania offers users a true dedication to this wonderful drink.

In here, you'll find the recipes and rituals associated with over 250 different coffees from around the globe. Plus there's advice on where to buy certain coffee beans, how to keep them, how to best serve them and how to best prepare your bean, so it's at its full potential when offered to the drinker.

Features At A Glance

- Coffee's magical powers were discovered by Ethiopian goat herders who saw the effects it had on their goats after eating the beans
- Coffee can help you live longer, apparently.
- Coffee contains important nutrients to help keep you healthy.
- Coffee increases your metabolism, so you're actually burning calories the more you drink (within reason).

Coffee Finder

Coffee Finder is an app that will help you find the nearest coffee shop, most probably complete with bearded hipster barista.

It's mainly US orientated, but there are UK maps in here, especially for central London. So the next time you feel the urge to partake in the drinking of this most special beverage and you're stuck for somewhere to go, check out the Coffee Finder – or simply look on the app store for a more localised version.

Conclusion

This handful of coffee apps should be enough to get you going. Needless to say, there are more coffee-related apps out there than you can shake a fistful of beans at. Which you prefer is as individual as the drink itself.



▲ No matter what your tastes, you'll find a coffee app for you



▲ So good, you can almost smell it



▲ This is just teasing now

Logging Off

Maybe it's my age, but I'm really beginning to wonder if the companies behind many of the technology products we use are heading in one direction and their customers in entirely another.

Results from Apple show it's reached saturation point for those people willing to part with £539 or more for some rehashed tech with a fruit logo on it. And probably unfairly, the stockholders' Eye

of Sauron is now focused on CEO Tim Cook to come up with something new to keep the share price heading up.

Apple's stockholders want the share value to go up forever, unrealistically, and the company wants everyone on the planet to have an iPhone, equally unrealistically. And, the paying public... Has anyone bothered to ask them what they'd like?

Apple might argue that it's done tons of research with focus groups, which tells them that the 'Rose Gold' colour option is much more important than value for money. But it seems market research is generally done to support ideas that the companies doing it already have and not to undermine their forward planning.

I should also mention that Apple's grip on reality was called into question recently, when it ran a promotional story about how it had recovered more than \$40 million of gold from its environmental efforts.

On first read, this sounds a remarkable achievement, given the frankly abysmal track record of Apple in saving the environment previously. But hang on... An average smartphone contains about 30 milligrams of gold, so that's 100 million iPhones that it's processed – or about 15% of the total amount ever sold.

If that seems high to you, then you'd be right to be sceptical, because Apple has processed hardly any iPhones to get that gold, because only a tiny fraction of them come back to Apple through its buy-back schemes. And most of those that do come back it refurbishes and then sells on in third world countries, where people are still impressed with the technology in the iPhone 4S.

What really happened? Well, Apple is legally required to recycle so much e-waste in proportion to the amount of products it actually sells. Therefore, it pays other companies to take old electronics, almost none of it made by Apple, and convert it into raw materials. These companies would recycle anyway, because they make money out of

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doing it, but they also now make money from Apple, which also pays for them to do it for it.

Companies that want to make the most money wouldn't look at mobile phones, because the amount of energy needed to get the £1.50-worth of elements out of them just isn't worth the effort. So they mostly process big items like old PCs, washing machines, tube TVs and the like, and they generally don't have fruity logos on them.

What's really disappointing about this story is that some Apple obsessive websites just ran the Apple press release on this story verbatim, without stopping for 30 seconds and wondering why these numbers just didn't add up.

It's about time people started to more seriously question what the likes of Apple, Google and Microsoft are doing and if it's really in our interest, because rather too often it isn't, and they need to be made aware that some of us have noticed.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Rayleigh Waves, 8 Ignite, 9 Newbie, 10 Egosurf, 12 Infer, 14 Vowel, 16 Gravity, 19 Beluga, 20 Gentoo, 22 Granulometric.
Down: 1 PAYG, 2 Claims, 3 Firearm, 4 Shunt, 5 Taiwan, 6 Resident, 11 Geometry, 13 Origami, 15 Equant, 17 Vanity, 18 Tails, 21 Odin.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. All week, people have been posting Star Wars stuff on Facebook, Twitter and so on, and our poor editor, Tony, has no idea why. Yes, he's that rarest of things: an adult male who doesn't like Star Wars. If it were any other series of cult movies, this wouldn't be a

problem. But this is Star Wars. If you don't like George Lucas's iconic creation, and other people find out, they want to know *why*? To paraphrase another renowned, massively influential series, one does not simply find Star Wars a bit boring. Clearly, there must be something wrong with him. Anyway, for some reason, everyone is using the phrase 'May the 4th be with you', and while he knows about the Force, Mr Enticknap doesn't get what the '4th' bit is about. Of course, he could just Google it, but he doesn't want to. Also, if someone catches him looking up Star Wars stuff, they'll probably assume he's a fan, and he'll get trapped in a conversation about TIE fighters and Jar Jar Binks.



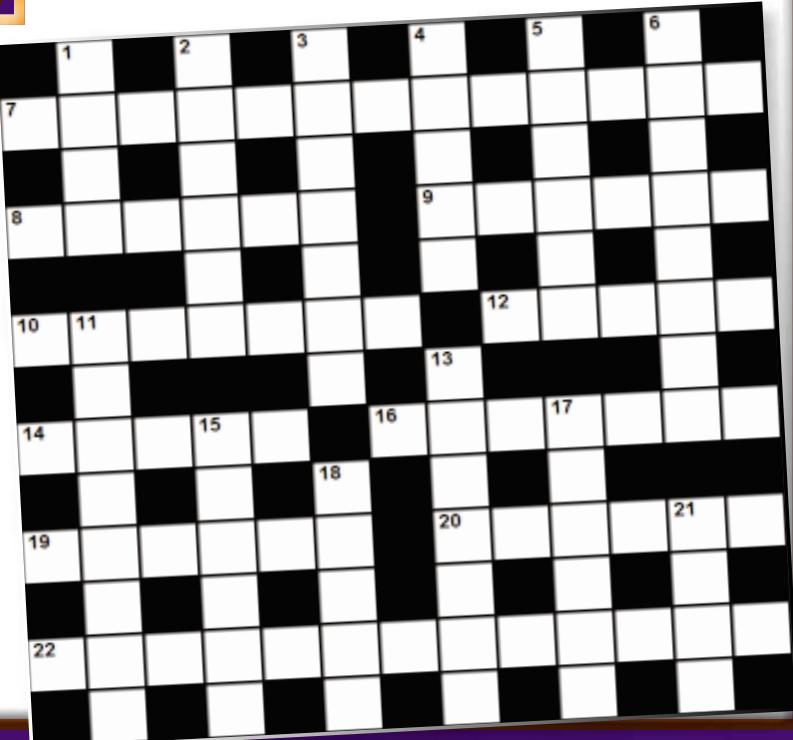
THIS WEEK'S CROSSWORD

Across

7 The arrangement or setup of the hardware and software that make up a computer system. (13)
8 The largest moon of Neptune. (6)
9 Widely known and esteemed. (6)
10 A virtual drive that is created by setting aside part of the random-access memory to use as if it were a group of sectors. (3,4)
12 A fastener with a helical thread used for joining things firmly or permanently together, put in place by turning under force. (5)
14 The achromatic colour of maximum lightness. (5)
16 Short accounts of the news. (7)
19 Compelling immediate action. (6)
20 A line of equal or constant pressure on a meteorological graph, plot or chart. (6)
22 The supposed ability to move objects by mental effort alone. (13)

Down

1 The only number that has the same number of characters as its value in the English language. (4)
2 The non-ministerial government department of Her Majesty's Chief



In Next Week's Micro Mart*

- Components special! Processors, motherboards, graphics cards, RAM and more
- Is Intel leaving the mobile sector good?
- How to create your own Spectrum loading screen
- Plus the usual mix of news, features, reviews and advice



* May be subject to change



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